Reliance **HY-CROME** *Spring Washers*

NO *Loose* BOLTS

Edgemark Of Quality

• All HY-PRESSURE HY-CROME provide parts protection through ground deflection.

HY-PRESSURE HY-CROME

Bolt Thread Diam.	SECTION SIZE Wid. C.	SECTION SIZE Thk. D.	Max. I. D. A.	Max. O. D. B.	Approx. Quantity In A Keg
¾	13/32	11/32	13/16	1 5/8	1,800
13/16	13/32	11/32	7/8	1 11/16	1,800
7/8	7/16	3/8	15/16	1 13/16	1,200
15/16	7/16	3/8	1	1 7/8	1,100
1	15/32	13/32	1 1/16	2	1,000
1 1/16	15/32	13/32	1 1/8	2 1/16	800
1 1/8	1/2	7/16	1 3/16	2 5/16	700
1 3/16	1/2	7/16	1 1/4	2 1/4	650
1 1/4	17/32	15/32	1 5/16	2 3/8	500
1 5/16	17/32	15/32	1 3/8	2 7/16	450
1 3/8	9/16	1/2	1 7/16	2 9/16	400
1 7/16	9/16	1/2	1 1/2	2 5/8	350
1 1/2	19/32	17/32	1 9/16	2 3/4	300

• **HY-PRESSURE HY-CROME** Spring Washers will provide automatic compensation for inevitable wear, and maintain a protective bolt tension.

• Other **HY-CROME** Spring Washers with specific track applications are available, fabricated to specific physical requirements under the supervision of experienced personnel.

• Cold drawn steel sections for all **HY-CROME** Spring Washers are produced in our own steel mill under the direction of our metallurgy lab.

• Prompt engineering service and deliveries at all times. Write for **HY-CROME** Track Folder.

EATON MANUFACTURING COMPANY
RELIANCE DIVISION MASSILLON, OHIO
Sales Offices: New York • Cleveland • Detroit • Chicago • St. Louis • San Francisco • Montreal

REPRODUCTION OF ADVERTISEMENT IN NEWSWEEK

SAFE CONDUCT FOR

thundering Locomotives

When the rail joints on busy main lines are treated with NO-OX-ID, track alignment is assured and locomotives can pound along with a high degree of safety. NO-OX-ID prevents corrosion caused by brine drippings, cinders, moisture, and other rust accelerators. It also acts as a lubricant which prevents rail joints from "freezing" caused by corrosion. One of the many uses for NO-OX-ID on railroads. Write for details.

Dearborn Chemical Company, NO-OX-ID Division, 310 S. Michigan Ave., Chicago 4, Ill.

NO-OX-ID
IRON + OX = RUST
REG. TRADEMARK AUG. 27, 1918

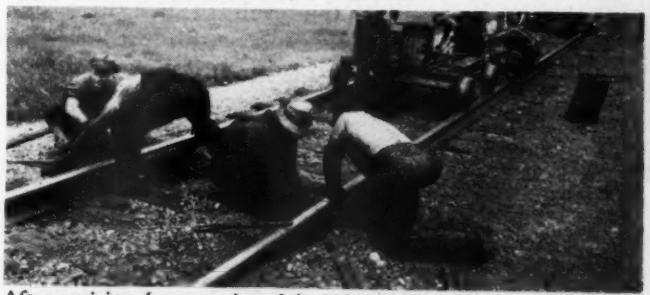
The ORIGINAL RUST PREVENTIVE

PROCEDURE TO FOLLOW TO PROVIDE THIS RAIL JOINT SAFETY

Flame cleaning and scraping of the rails fishing area is the first step in NO-OX-ID's treatment of rail joint assembly.

Power brush cleaning of the fishing area of the rail follows to remove scale and loose particles of rust.

The NO-OX-ID coating is then applied with a brush to the fishing area of the rail, to angle bars, track bolts, and rail ends.



After receiving the protection of the NO-OX-ID applications, the rail joint is reassembled, and the track bolts are tightened.

NO-OX-ID not only prevents corrosion, but acts as a lubricant.

DEARBORN CHEMICAL COMPANY
Dept. U, 310 S. Michigan Ave., Chicago
New York • Los Angeles • Toronto

Published monthly by Simmons Boardman Publishing Corporation, 105 W. Adams St., Chicago 3, Ill. Subscription price: United States and Possessions, and Canada, $2.00; Foreign, $3.00. Single copies 35 cents. Entered as second-class matter January 20, 1933, at the post office at Chicago, Ill., under the act of March 3, 1879, with additional entry at Mount Morris, Ill., postoffice. Address communications to 105 W. Adams St., Chicago 3, Ill.

I'm Going Your Way Too

He: "Pardon me, but I see you're heading in the right direction—going for those modern parcel lockers. I can't help asking why you are making such a bee-line for them . . . Miss . . . ?"

She: "Just call me Miss Travel-Wise. I get around a lot. And I really don't have to tell you how convenient they are . . . and save so much time . . . no standing in line . . ."

They say: We're *all* travel-wise today, and that means locker-wise. We like to be free to come and go as we please on a moment's notice or whim . . . and you can, too . . . because the Key is Your Check!

Yes. Surveys show that travelers prefer parcel checking lockers. We shall be glad to send you the results of such surveys or make local surveys and recommendations without obligation . . . for the installation of lockers, or for their inclusion in your plans for renovation or new building.

AMERICAN LOCKER COMPANY, Inc.

211 CONGRESS ST., BOSTON 10, MASS.

DISTRICT OFFICES

BOSTON · NEW YORK · PHILADELPHIA · PITTSBURGH · ATLANTA

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A Nation-Wide Service

CHECK THE MODERN WAY . . . . THE KEY IS YOUR CHECK


Versatility
NO TRACK TYPE CRANE CAN EQUAL!
What's your problem? Is it an "off the track" job or is it on the line? Whichever it is you can put your Northwest on location quickly. It loads itself on a standard flatcar or gondola or you can roll it over the highway on a trailer. On the job it will work from the car or it can be unloaded under its own power for work off the line.
Northwests build shoulders, ditch right-of-way, open up drainage ditch, build bridges, set steel, set culvert, handle rail, drive piles, trim bank, widen cuts, build fill—anything and everything that calls for material handling or excavation is their job—on the track or off.
It does things no track type machine can do. Many of the country's leading railroads are using them. Let us send you details. They are built in a range of 18 sizes 3/8 yd. capacity and larger. There is a size for every job.
NORTHWEST ENGINEERING CO.
1713 Steger Building • 28 East Jackson Boulevard
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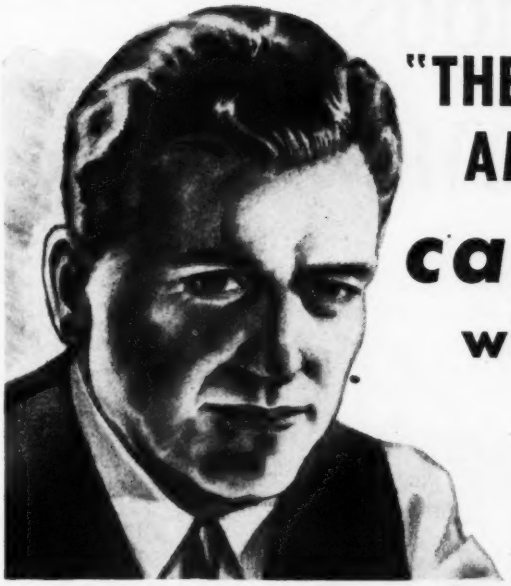
NORTHWEST
THE ALL PURPOSE RAILROAD MACHINE
SHOVEL • CRANE • DRAGLINE • PULLSHOVEL
PROVED
on the nation's
LEADING
RAILROADS

YOUR JACKSON MAINTENANCE MAN SAYS:



"THE MAJORITY OF LEADING AMERICAN RAILROADS *can't be wrong* when they REORDER JACKSON VIBRATORY TAMPERS"

A FEW USERS

Atchison, Topeka & Santa Fe Ry. Co., The
Atlantic Coast Line R. R.
Boston & Maine R. R.
Central of Georgia Ry. Co.
Chicago & North Western Ry. Co.
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National Railways of Mexico
New York Central System
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Pere Marquette Railway Co.
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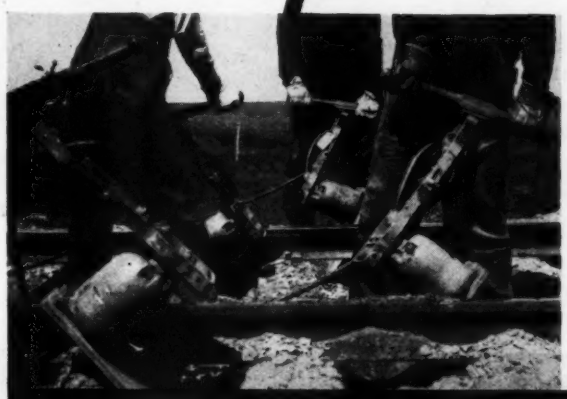
Seaboard Air Line Ry.
Southern Ry. System
Texas & New Orleans R. R. Co. (Southern Pacific Lines in Texas and Louisiana)
Texas & Pacific Ry. Co., The
Union Pacific R. R.
Wabash R. R. Co.

Despite severe restrictions on materials for production of maintenance equipment, increases over 1944 budgets are indicated for 1945 work-equipment items. The continuing need for mechanized maintenance tools is demonstrated in the liberal 1945 commitments made for JACKSON ***vibratory*** Tampers and Portable Power Plants. A large volume of these represent repeat business from long-time users.

Preference for JACKSON Tampers stems from their consistent performance over a period of 25 years, in all sections of the country, on a majority of American railroads. Adapted to ***any ballast*** and ***all lifts***, vibratory tamping is fast, uniform and economical.

And, JACKSON Tampers are easy on the inexperienced operator. The combination of weight, balance and vibratory action does any tamping job effectively and quickly. All the operator has to do is guide the tamper — the machine does the work.

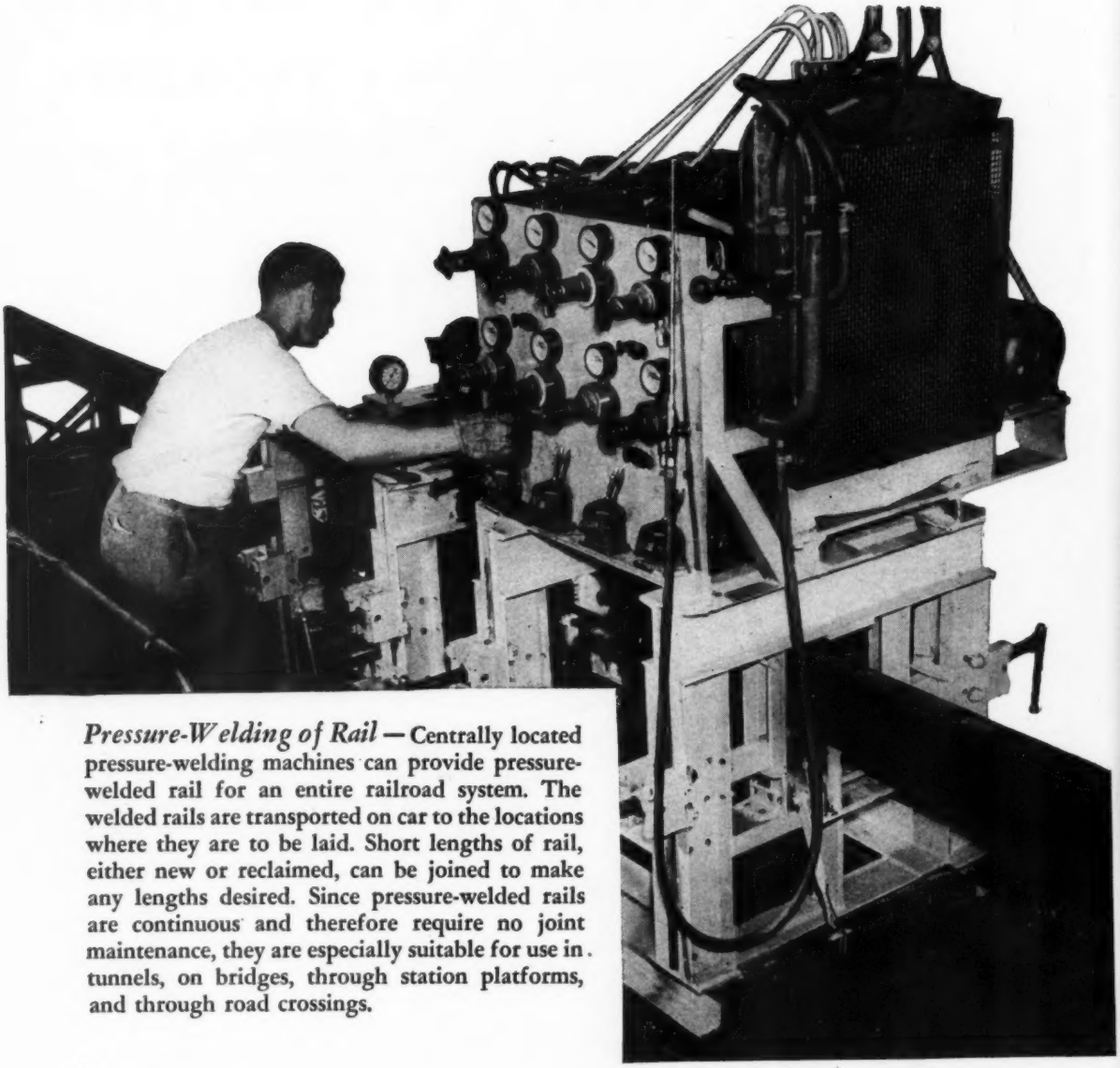
If you need more tampers for next year, now is the time to write for complete information on JACKSON Vibratory Tamping methods and equipment.



ELECTRIC TAMPER & EQUIPMENT CO., Ludington, Michigan

Oxweld Methods

Speed Maintenance



Pressure-Welding of Rail — Centrally located pressure-welding machines can provide pressure-welded rail for an entire railroad system. The welded rails are transported on car to the locations where they are to be laid. Short lengths of rail, either new or reclaimed, can be joined to make any lengths desired. Since pressure-welded rails are continuous and therefore require no joint maintenance, they are especially suitable for use in tunnels, on bridges, through station platforms, and through road crossings.

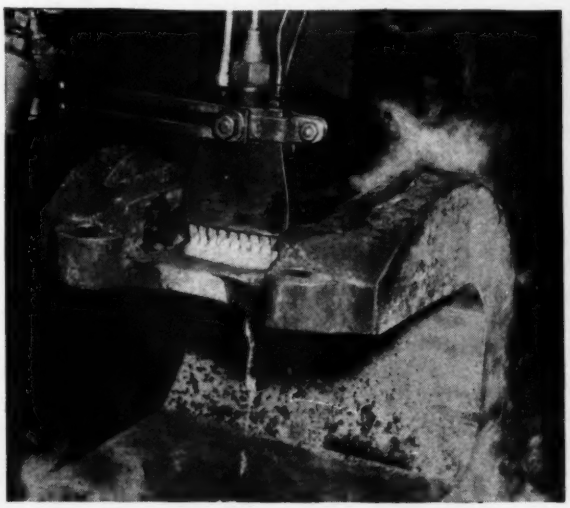
SINCE 1912 — THE COMPLETE OXY-ACETYLENE SERVICE FOR

BUY UNITED STATES WAR BONDS AND STAMPS

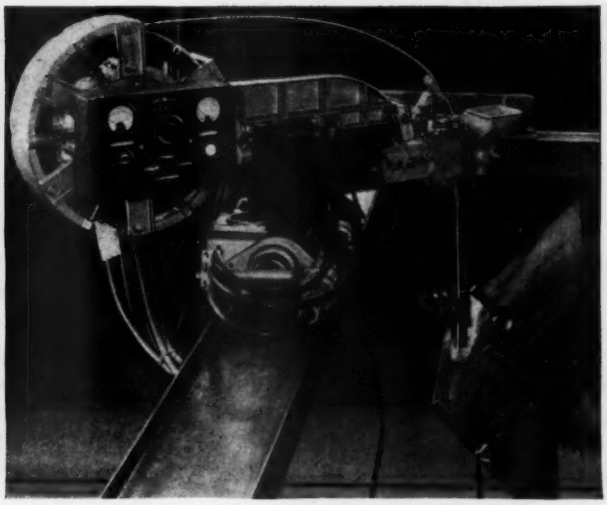
and Rebuilding Programs

• For over thirty years Oxweld has made available to the railroads, methods and equipment which have helped to maintain efficiency and to lower operating costs. Three of Oxweld's methods in general use today . . . pressure-welding of rail, flame-hardening, and UNIONMELT welding . . . are illustrated here. An Oxweld representative will be glad to tell you more about these and other Oxweld methods.

THE OXWELD RAILROAD SERVICE COMPANY
Unit of Union Carbide and Carbon Corporation
Carbide and Carbon Building UCC Chicago and New York



Flame-Hardening — By means of the oxy-acetylene flame, a wear-resistant surface case can be given to wearing parts—such as this engine truck box—at the exact points where wear occurs and without affecting the chemical composition or toughness of the core.



Unionmelt Welding — UNIONMELT automatic electric welding joins steel of any thickness at speeds up to 20 times faster than other methods of welding with rods . . . without sparks, spatter, smoke, or flash.

The word "Unionmelt" is a registered trade-mark of The Linde Air Products Company.

AMERICAN RAILROADS

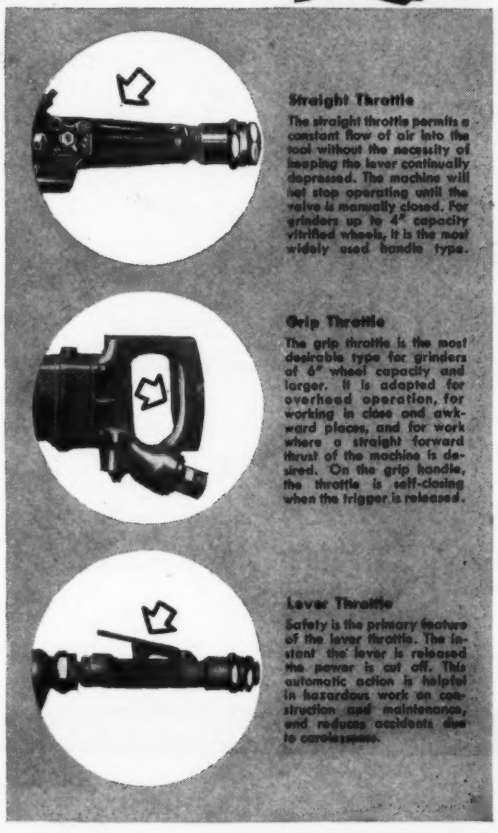
Tough Grinding Jobs MADE EASY with

Thor PORTABLE AIR GRINDERS

On the heaviest, toughest type of grinding jobs Thor rotary air grinders are unsurpassed for turning out a large amount of work each day. Extremely well balanced and ruggedly built, Thor portable grinders are leading the field for dependable, continuous service at a minimum maintenance cost. These efficient grinders have an abundance of mighty power and yet are exceptionally thrifty on the air they require to operate.

WIDE RANGE OF SIZES AND MODELS

There are 50 different sizes and models of Thor rotary air grinders . . . a model for any and every type of grinding job. All of the models can be furnished with either of the three throttle types shown. For full details, specifications, prices and delivery information, write for Thor Catalog No. 52B.



Straight Throttle
The straight throttle permits a constant flow of air into the tool without the necessity of keeping the lever continually depressed. The machine will not stop operating until the valve is manually closed. For grinders up to 4" capacity vitrified wheels, it is the most widely used handle type.

Grip Throttle
The grip throttle is the most desirable type for grinders of 6" wheel capacity and larger. It is adapted for overhead operation, for working in close and awkward places, and for work where a straight forward thrust of the machine is desired. On the grip handle, the throttle is self-closing when the trigger is released.

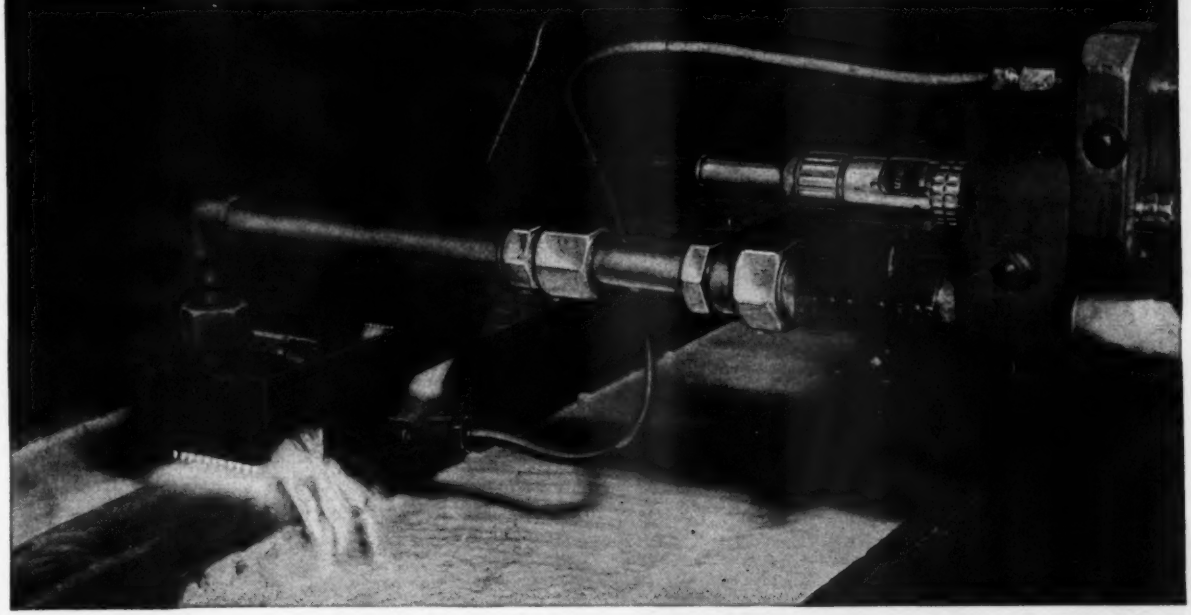
Lever Throttle
Safety is the primary feature of the lever throttle. The instant the lever is released the power is cut off. This automatic action is helpful in hazardous work on construction and maintenance, and reduces accidents due to careless use.

INDEPENDENT PNEUMATIC TOOL COMPANY
600 W. Jackson Blvd., Chicago 6, Illinois
Los Angeles New York

Thor PORTABLE Electric & Pneumatic TOOLS
Branches in Principal Cities

SIMULTANEOUS FLAME HARDENING AND TEMPERING

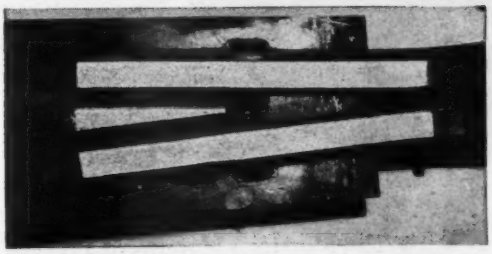
lengthens life of open hearth steel frogs



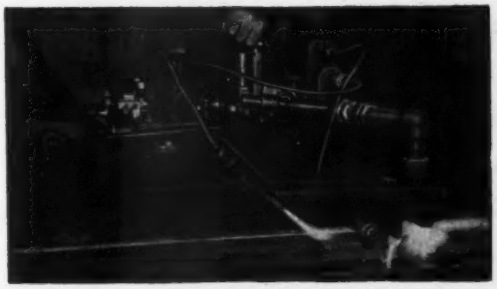
INCREASE the wear resistance of new carbon steel frogs and thereby lengthen their service life by using the modern method of simultaneous flame hardening and tempering. First developed by Airco's Field Engineering Staff, this economical surface hardening method imparts a hard "skin" to frog points and wing rails at the areas where wear is usually most severe. It provides sufficient hardness to retard wear and reduce battering of the surface to a minimum without affecting the toughness and shock resistance of the core metal.

The actual mechanical application of Airco's Simultaneous Flame Hardening and Tempering is simple, speedy, and economical. The most practical method is to immerse each of the component parts of the frog almost completely in a tank containing a soluble oil solution. An Airco No. 4 Radiagraph machine, equipped with quenching jet and torches for heating and tempering, travels at a regulated speed on a track alongside the tank. Thus, in a single progressive operation the frog wearing surfaces are flame hardened and tempered.

Air Reduction's Railroad Engineering Service Division will provide complete information and technical assistance on this application of the oxyacetylene flame. For full details write to Department REM, New York office.



This view of an assembled frog shows the areas (chalk-marked) which have been flame hardened.



Close-up of the operation showing the hardening flame, quenching jet and tempering flame.

★ BUY UNITED STATES WAR BONDS ★

AIRCO

AIR REDUCTION

General Offices: 60 EAST 42nd STREET, NEW YORK 17, N. Y.

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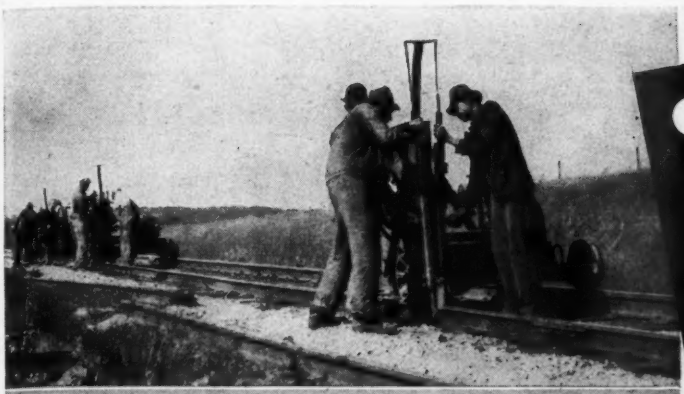
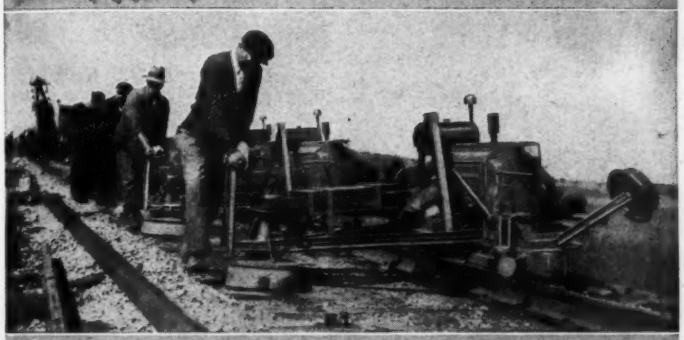
● The Morrison Metalweld Process of "IN TRACK" Frog and Crossing rejuvenation is a smoothly working and experienced combination of three factors ... MEN, MACHINES and METHODS. Morrison has this combination which, over a period of years, has serviced many thousand Frogs and Crossings for many lines. Much of this work is handled on an annual contract arrangement with several of the nation's leading railroads. To our way of thinking, these contracts represent the best proof and guaranty of the Patented Morrison Metalweld Process. We would like to explain this service to you in greater detail. May we?

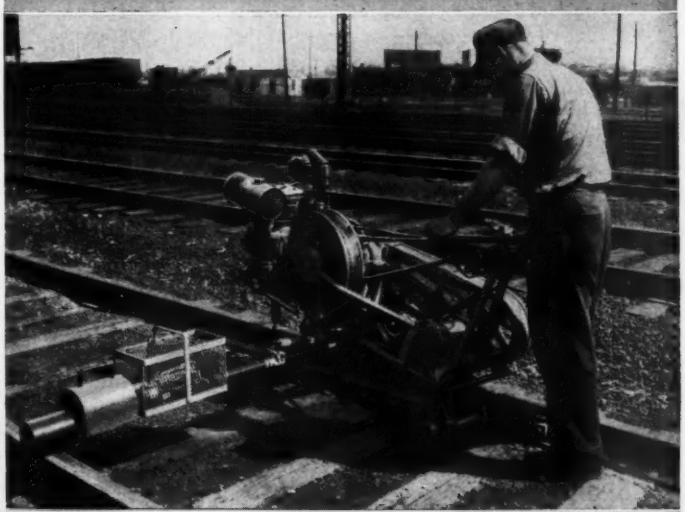
MORRISON METALWELD PROCESS, INC.
A SUBSIDIARY OF
MORRISON
RAILWAY SUPPLY CORP.
EXECUTIVE OFFICES ... BUFFALO 12, N. Y.
CHICAGO 4, ILL. BIRMINGHAM 3, ALA.



Three Spike Pullers at the head of the rail laying gang speed up all operations by the quick removal of spikes.



Four Adzing Machines provide properly adzed tie seats for the new rail; all level and in the same plane.



Nordberg Power Wrenches remove the nuts from the old rail and uniformly tighten nuts on the new rail.

● Lay that rail with the aid of NORDBERG POWER TOOLS

A rail laying gang is equipped for speed, better quality of work and low cost operation when the *spike pulling, tie adzing and bolt tightening* is done with Nordberg Power Tools. The advantages of these labor saving tools has been proved on most of the nation's progressive railroads who have completely mechanized their operations with Nordberg machinery.

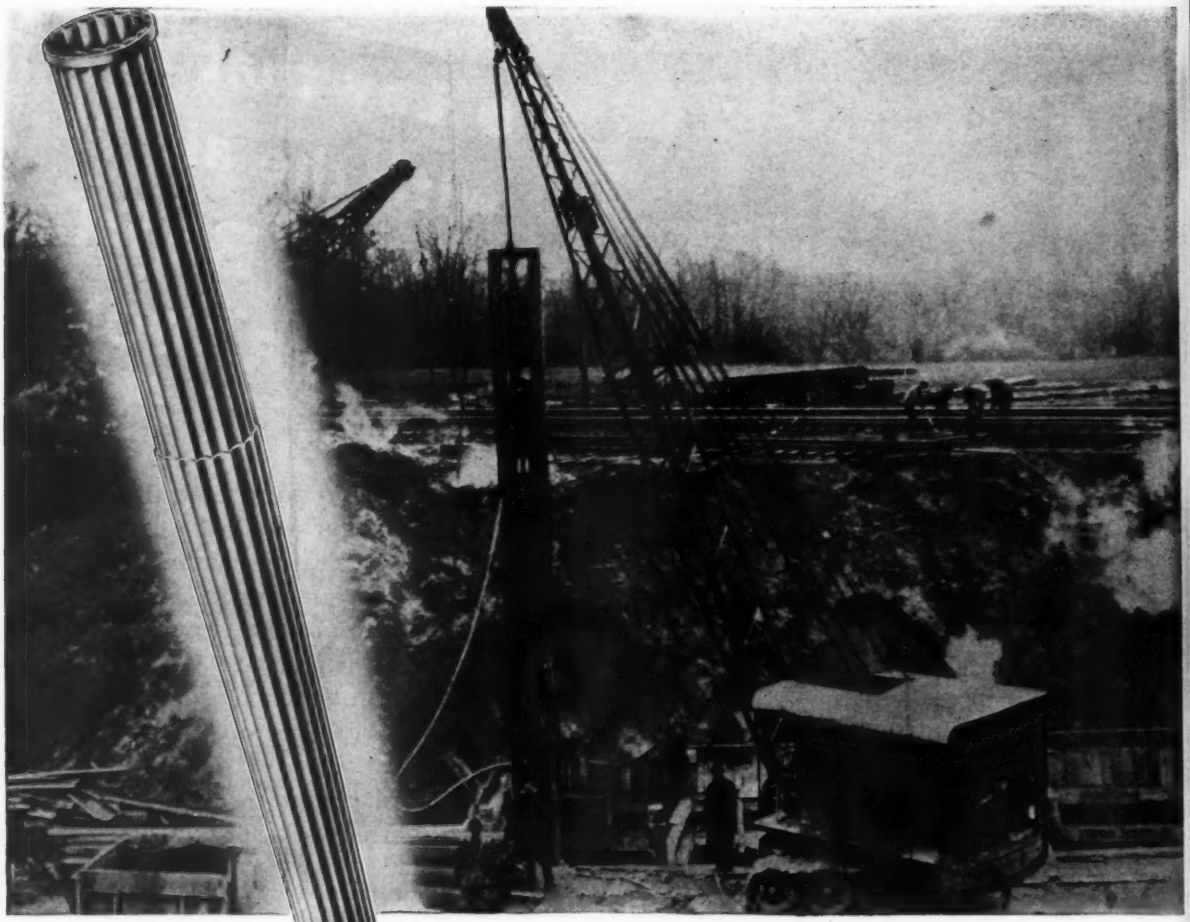
In addition to laying rail, other Nordberg tools are available for a variety of track maintenance work. There are five types of Grinders for reconditioning and maintaining rail, switches, crossings, etc. A compact, lightweight Rail Drill will be found useful where drilling is done. On ballasting and surfacing jobs there is the hydraulic Power Jack which greatly speeds up raising as compared with hand methods.

Nordberg Power Tools on the job will combat the manpower shortage and at the same time enable you to maintain your track in keeping with wartime traffic demands.

NORDBERG MACHINERY

NORDBERG MFG. CO. MILWAUKEE WISCONSIN

Export Representative—WONHAM Inc.—44 Whitehall St., New York



MONOTUBES
Designed for Men Who Install Piled Foundations

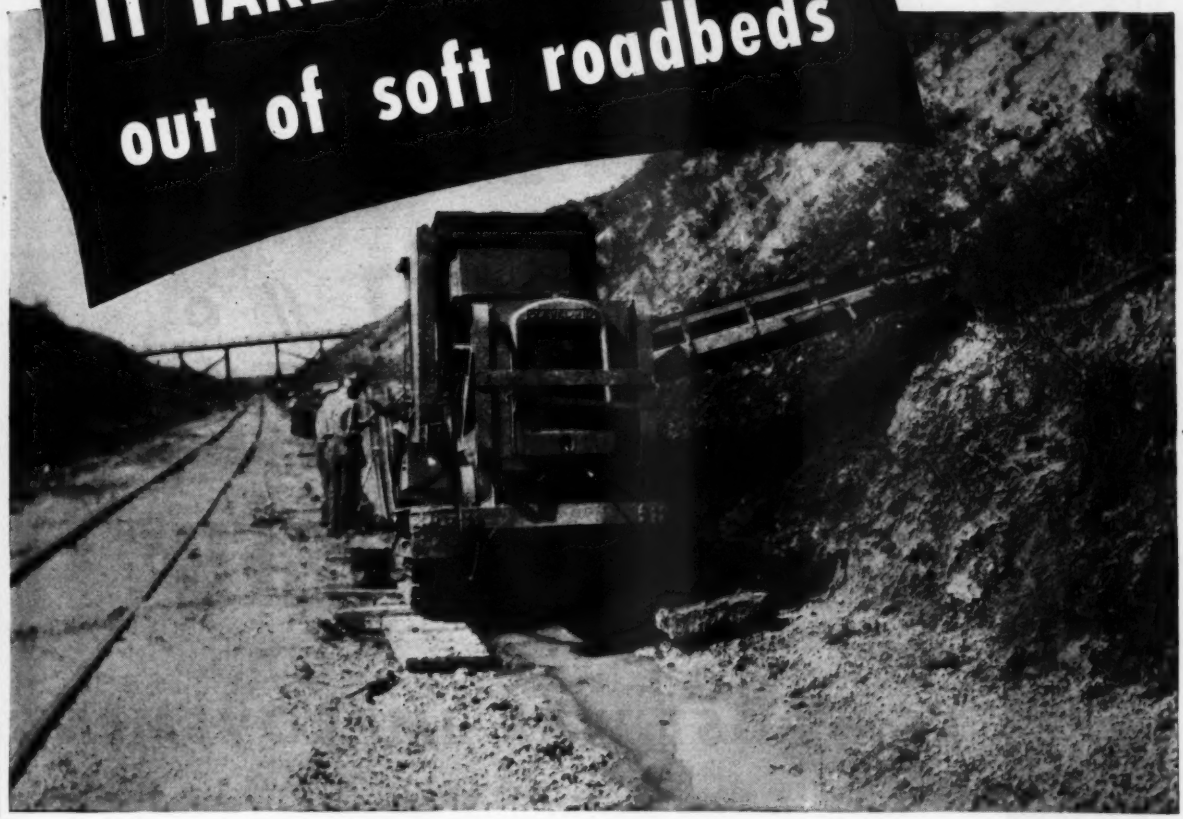
MONOTUBES—the all-steel tapered piles—are on the job helping engineers and contractors build better foundations for war or peace.

Their light weight makes Monotubes easy to handle on the job. Their tapered, fluted construction permits fast driving with average job equipment, and without heavy core or mandrel. Their tubular design simplifies inspection prior to concreting. And, best of all, they can be quickly and easily extended on the job to meet any contingencies of varying soil conditions.

Remember these special advantages the next time you require piled foundations . . . remember Monotubes. Available in a gauge, size, and taper to meet all needs. Free Catalog 68A gives complete information. Write The Union Metal Manufacturing Company, Canton 5, Ohio.

UNION METAL
Monotube Tapered Piles

IT TAKES THE SHIMMY out of soft roadbeds



Slides and saturated subgrade once made this 3000-foot cut troublesome to an important freight line in the West. Here workmen are installing 8-inch ARMCO Perforated Pipe at 9-foot depth, backfilling with gravel and sealing the top with clay to prevent entrance of surface-water.

Water pockets are unwelcome bedpartners on any rail line. They soften the subgrade, give roadbeds the fidgets, and are a constant source of worry and expense.

Strong, tight-jointed ARMCO Perforated Pipe is a sure cure. Proper use of this durable pipe assures fast, efficient subdrainage—either in old or new roadbeds.

For years this western rail line was plagued by trouble-making groundwater. Maintenance costs were high. So engineers installed ARMCO Perforated Pipe. Now, thanks to a firm dry subgrade, it costs far less to keep the roadbed in top shape. It will *stay that way too.*

ARMCO Perforated Pipe resists crushing and disjointing. Flexible, corrugated metal design and strong, tight joints see to that. It ends your worries over traffic vibration, heavy loads, shifting soils or frost action.

This sturdy pipe is easy to install. No special tools are needed. Long lengths are quickly joined by sturdy coupling bands to form a strong, trouble-free conduit. The job soon pays for itself in lower maintenance costs. Ask us for the facts. Write the Armco Railroad Sales Co. Incorporated, 281 Curtis Street, Middletown, Ohio, or to our nearest district office.

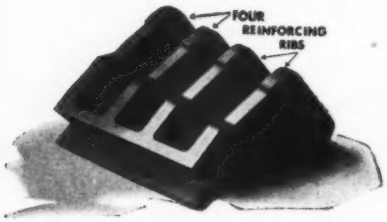
ARMCO

ARMCO PERFORATED PIPE

Morden Security Adjustable Rail Brace

COMPLETE BRACE ASSEMBLY

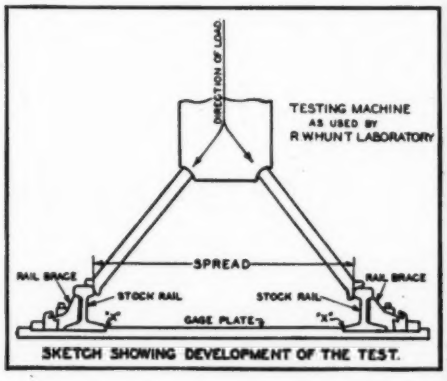
INDIVIDUAL PARTS OF BRACE



UNDER SIDE OF BRACE
Four reinforcing vertical ribs, which extend from rail web to floor of brace plate, afford the greatest possible structural strength to the design.

The improved Morden Security Brace is specially designed to meet the needs of wartime traffic by providing adequate support for rails subjected to the thrust of heavy wheel loads. The Brace is adapted particularly for use in split switches and slip switches in interlocked territory where it is essential to hold stock rails to proper gage and alinement.

Simple in design, the Brace can be quickly installed, adjusted or removed, without disturbing either rail, tie or plate. Rigorous loading tests have shown that the Security Brace will support a weight of 50,000 lb. at a 45 deg. angle, with a spread of only ⅛ in., and a spread of only one inch when this weight is raised to 200,000 lb.

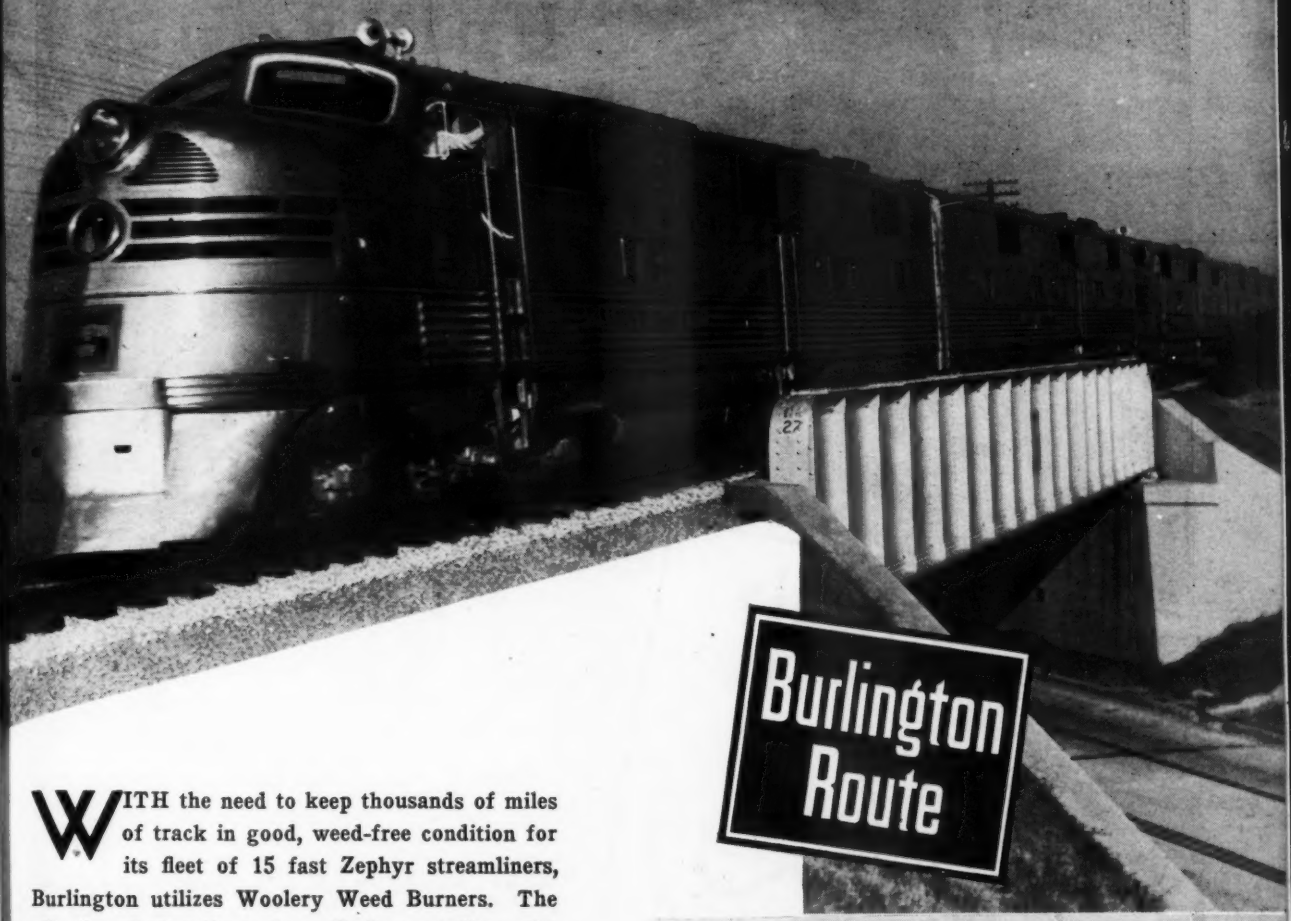


For more than 60 years Morden has pioneered in the construction of frogs, switches, crossings, guard rails, gage rods, rail braces and security track work. Let our engineers help you solve your track maintenance problems.

Morden Frog and Crossing Works CHICAGO, ILL.

Representatives in: CLEVELAND, OHIO; NEW ORLEANS, LA.; LOUISVILLE, KY.; ST. LOUIS, MO.; WASHINGTON, D. C.

For Weed-Free Track—
Burlington Uses Woolery Weed Burners

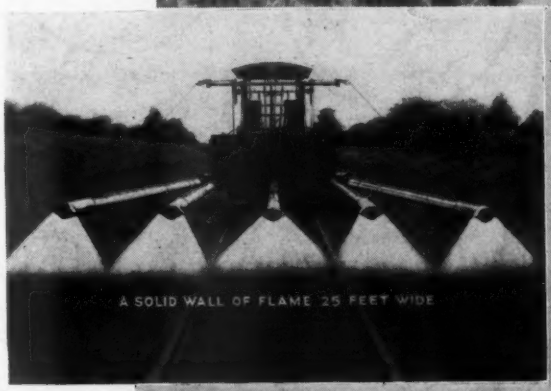


WITH the need to keep thousands of miles of track in good, weed-free condition for its fleet of 15 fast Zephyr streamliners, Burlington utilizes Woolery Weed Burners. The effective destruction of roadbed vegetation with Woolery Burners facilitates drainage, increases life of ties, reduces fouling of ballast and minimizes slipping of locomotive drive wheels.

Doing a thorough job economically is the reason why over 75 roads use Woolery Weed Burners, Tie Cutters and Creosote Sprayers.

WOOLERY WEED BURNERS

Available in 5-burner, 3-burner, 2-burner and 1-burner models.



Woolery 5-burner in action

WOOLERY MACHINE COMPANY

MINNEAPOLIS — Pioneer Manufacturers of — MINNESOTA

RAILWAY MAINTENANCE EQUIPMENT

RAILWAY WEED BURNERS • MOTOR CARS • TIE CUTTERS • TIE SCORING MACHINES • RAIL JOINT OILERS • CREOSOTE SPRAYERS • BOLT TIGHTENERS

EXCLUSIVE EXPORT REPRESENTATIVES: PRESSED STEEL CAR COMPANY, INC., PITTSBURGH, PENNA.

ROADBEDS

— a necessity for maintenance of track to meet requirements of present day tonnage and speed.

265 Moles are in use on 28 railroads.

Write Today

For Complete Information

McWilliams
"Mole" Ballast Cleaners
Available in both intertrack and border models

RAILWAY MAINTENANCE CORP.

PITTSBURGH 30, PENNSYLVANIA

When OVERHEAD is UNDERFOOT...

It's a comfortable feeling . . .

To know that your overhead, underfoot, is under control . . .

To know that your flooring cost is low, and will stay low . . .

That your floors can stand heavy traffic, without undue wear . . .

That your floors are warm and shock-absorbent . . . help employees avoid fatigue.

That's why it's a comfortable feeling . . . when you walk across your Flintkote Mastic Floor.

Flintkote Mastic is *modern* utility flooring. It was designed and developed expressly for all industrial conditions from foot traffic to continuous steel-wheel trucking.

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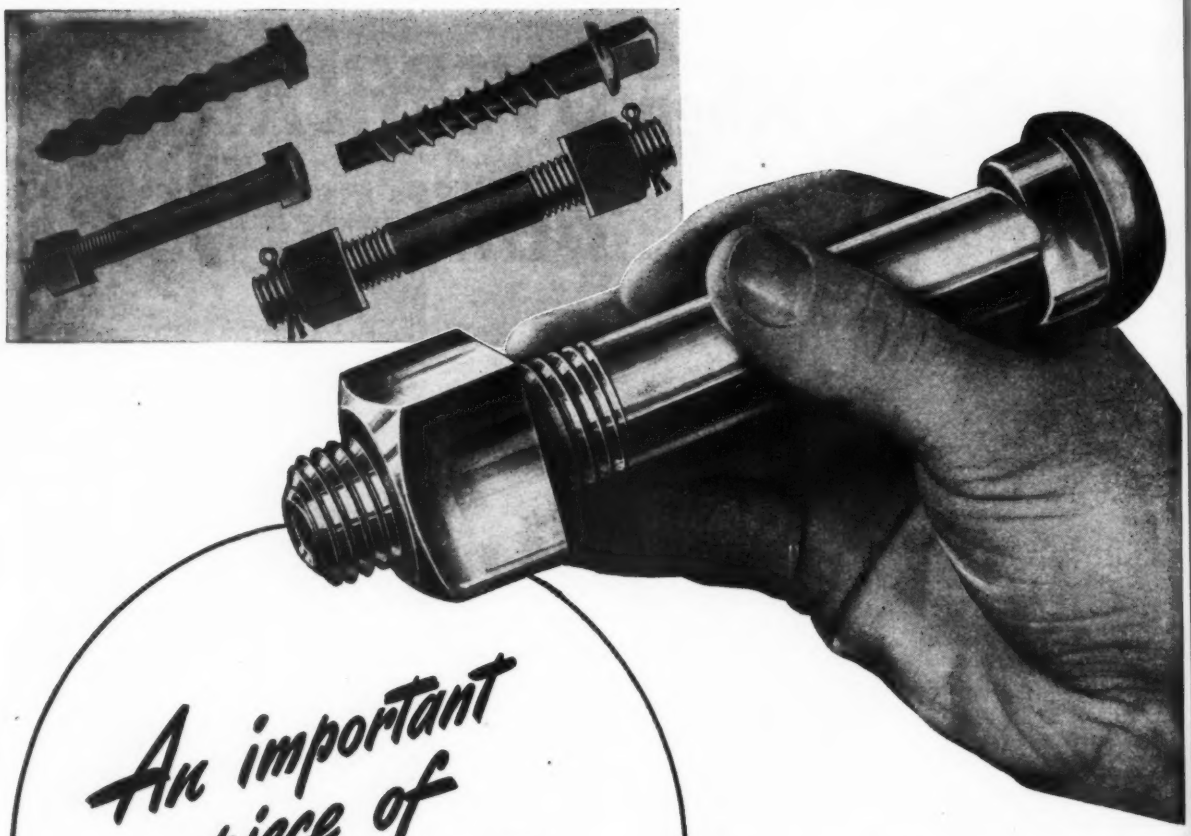

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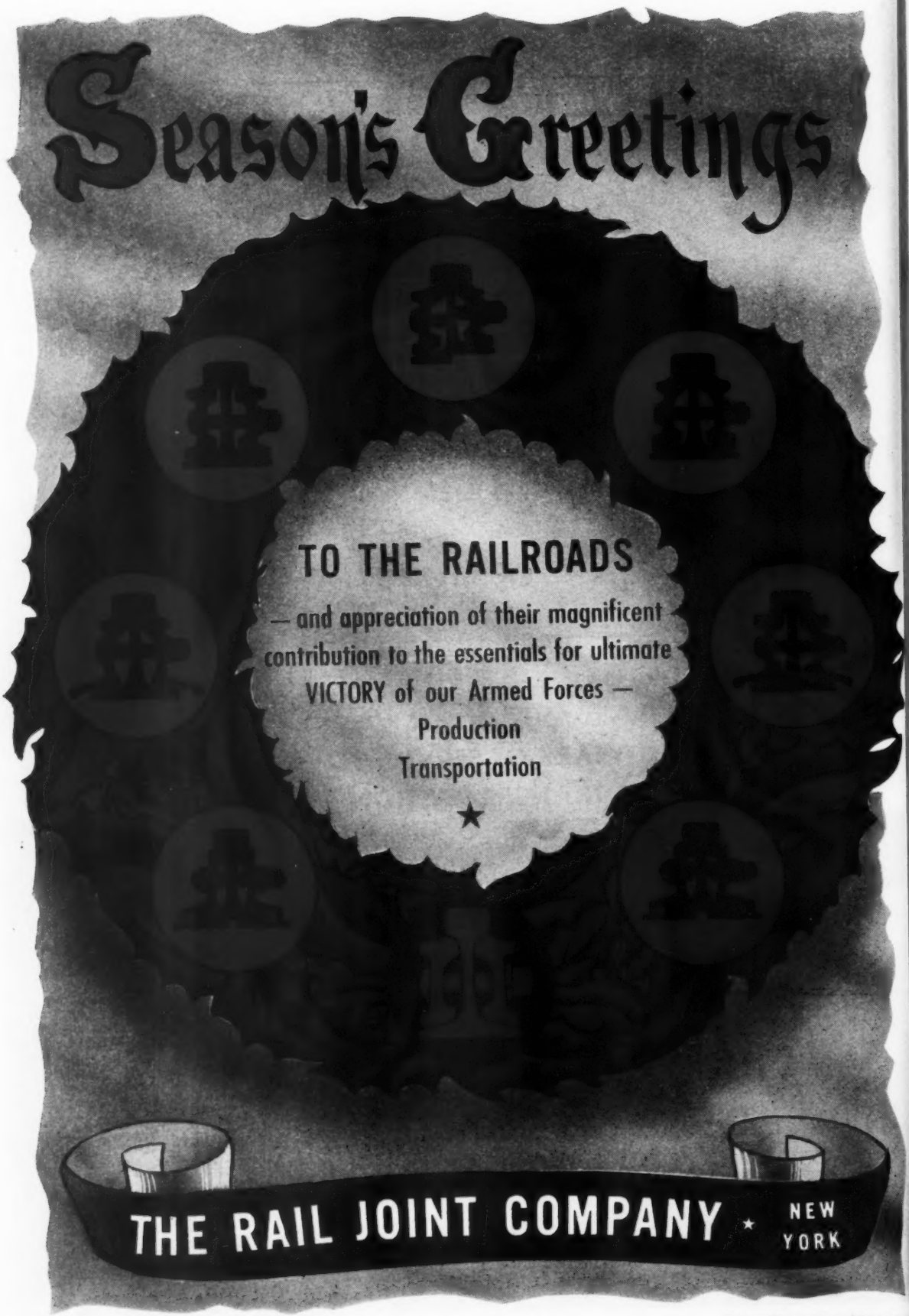
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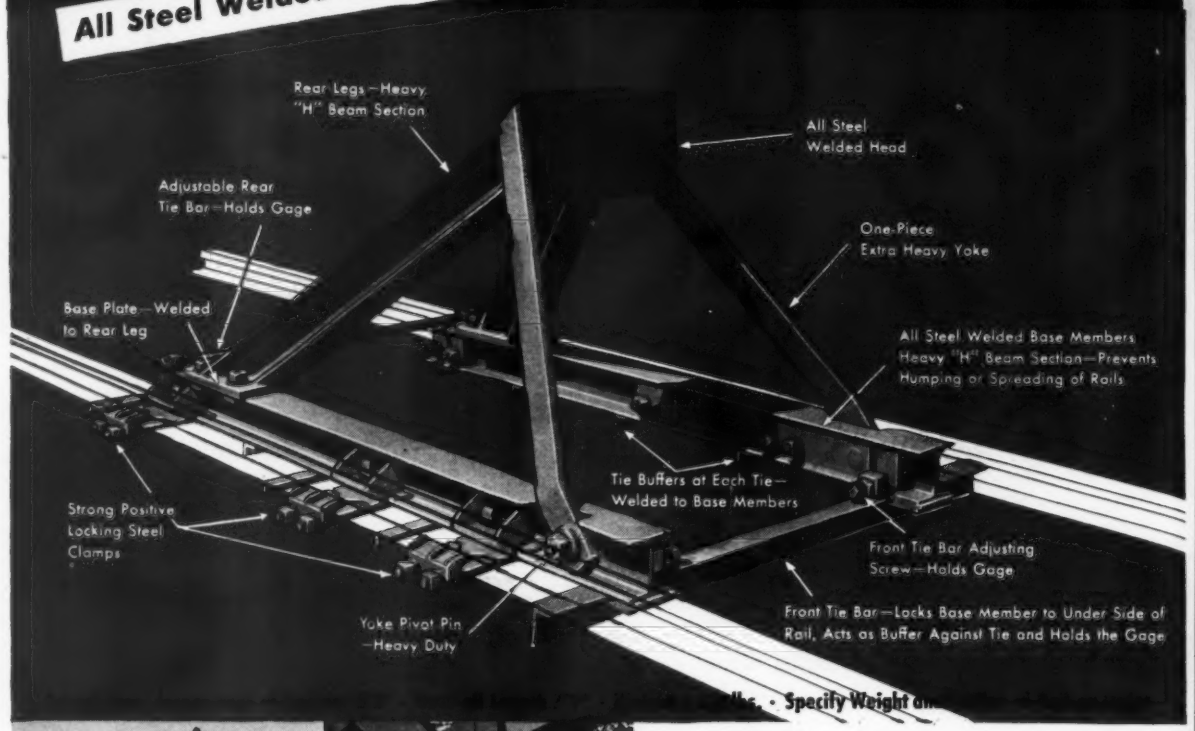
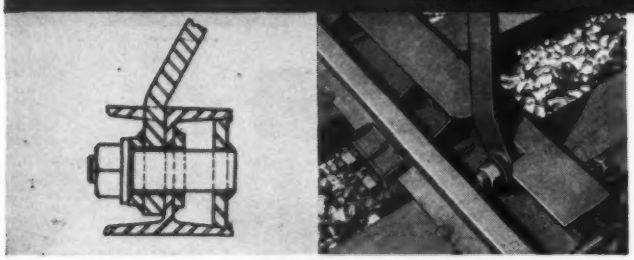
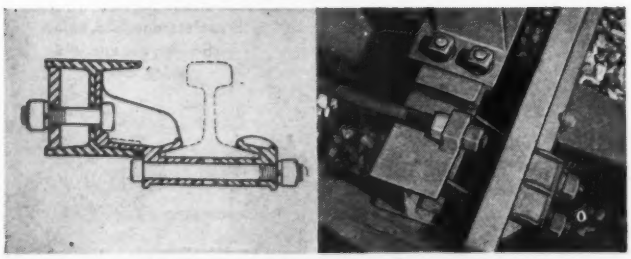




Cross section and illustration of extra heavy steel yoke bar pivot connection to base member



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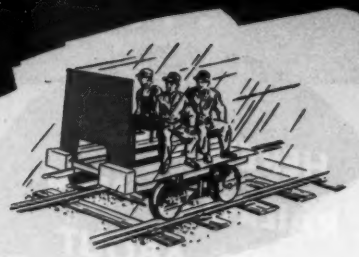

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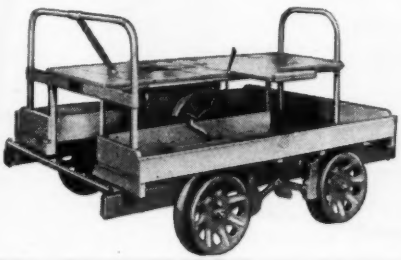

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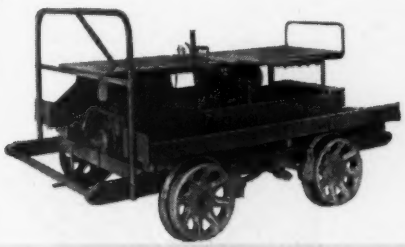

SHEFFIELD MODEL 44-B—The standard section car on many railroads. Sturdy, roomy. Weighs 1095 pounds. Has ample power to haul trailers loaded with men, tools or ties. Water-cooled 8- to 13-hp. engine with air-cooled head. Chain drive.

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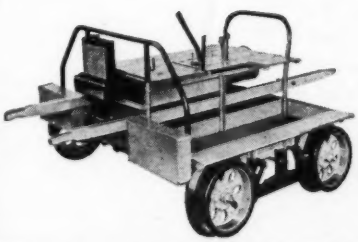

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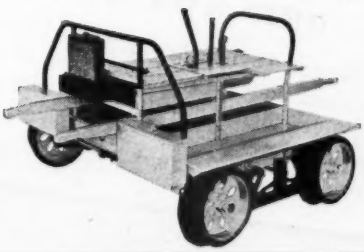

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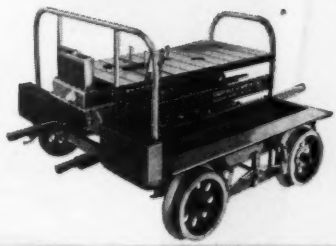

SHEFFIELD MODEL 54-B—Inspection car for 1 to 4 men. Has 5- to 8-hp., water-cooled engine—self-centering, powerful brakes, wood center wheels—adjustable rear axle box—and is chain-driven. Model 754-B is belt-driven.

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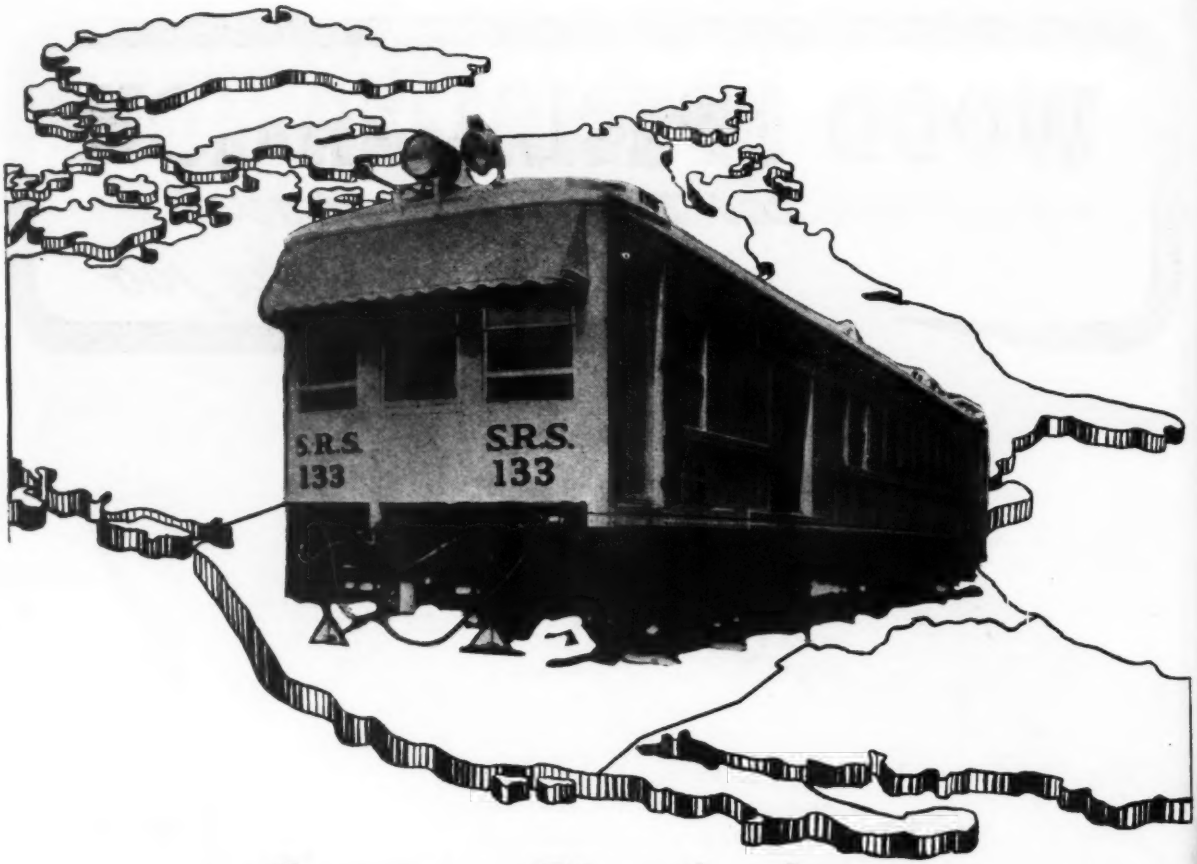

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No. 193 of a Series

Railway
Engineering and Maintenance
SIMMONS-BOARDMAN PUBLISHING CORPORATION
105 WEST ADAMS ST.,
CHICAGO, ILL.

Subject: Victory--
And a Happy New Year

January 1, 1945

Dear Readers:

Late necessarily, but no less sincere, we of the staff of Railway Engineering and Maintenance extend to you our congratulations for your many outstanding achievements of the last year, and our heartiest good wishes for you in your endeavors in the strenuous year that lies ahead.

You are not unaware of the difficult year just past--of the many added problems occasioned by heavier traffic in the face of insufficient material, equipment and labor--and most of you have worked harder, longer and more diligently than ever before. But how many of you realize fully the import of the last twelve months and the contribution that you have made toward it? In many respects, 1944 will go down as the most outstanding year in railroad history. With your help, the railroads measured up to every demand of the war effort, and helped carry our fighting forces one year nearer victory. For this, we who have tried to help you in your efforts, extend our congratulations.

But as the new year dawns, it is only too evident that the war is not yet won. The year 1945 will certainly bring us victory in Europe and one year nearer victory in Asia, if we all do our part, but there is still much fighting ahead, and until complete victory is achieved, your war job is not done. We know that you realize this and that you are resolved to give your best in the year ahead--that you will continue to uphold and enhance the tradition of railroad men built up through every emergency in the past. In your determination you have our most sincere best wishes. More than that, it is our resolve to endeavor to be more helpful to you than ever before.

Happiness in the year ahead--yes, we wish you that too--but first and foremost, we wish for our country rail transportation adequate to speedy victory, whatever the cost, knowing that none of us can have that happiness until victory is achieved. We know that this is your most fervent wish too.

Sincerely,

Neal D. Howard

Editor

MEMBER: AUDIT BUREAU OF CIRCULATIONS AND ASSOCIATED BUSINESS PAPERS, INC.

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NAME REGISTERED U. S. PATENT OFFICE

JANUARY, 1945

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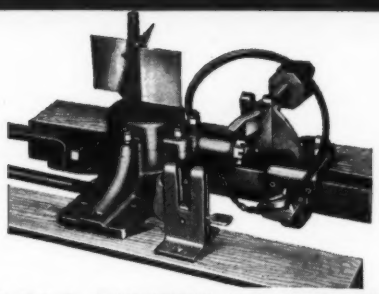

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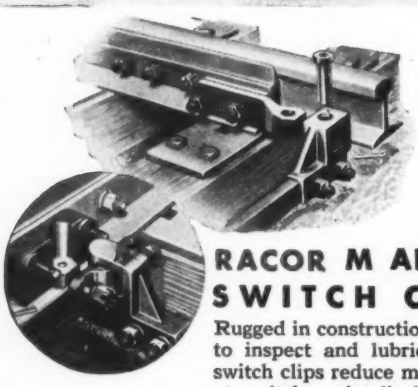

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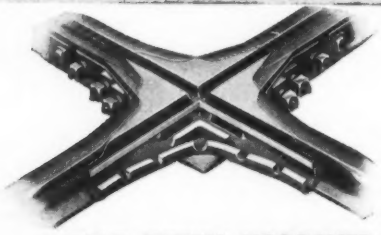

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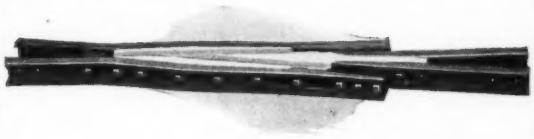

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Railway Engineering and Maintenance

1944 In Review

Railways Reach New Highs in Achievement

The achievements of the railways in 1944 will, unquestionably, go down in history as among the most outstanding in their long period of service to the country—in peace or in war. In that year, spurred by the peak and exacting demands of the war, the railways met every test, while at the same time establishing many new records of performance and efficiency. Among the indices of their achievements, in which every maintenance officer can claim a part, directly or indirectly, are the following, which have been compiled by Dr. Julius H. Parmelee, director of the Bureau of Railway Economics of the Association of American Railroads.

The freight traffic handled by the railways reached a new high in 1944. Revenue ton-miles of freight approximated 740,000,000,000, compared with 727,075,000,000 in 1943, an increase of 1.8 per cent. This was considerably more than twice as great as that handled in 1939, was one and two-thirds times that in 1929, the peak year prior to the war, and was one and five-sixths times that in the earlier war year 1918. Passenger traffic, measured in revenue passenger-miles, likewise reached a new high in 1944, amounting to 96,000,000,000 passenger-miles. This compares with 87,820,000,000 passenger-miles in 1943, 22,651,000,000 passenger-miles in 1939, 46,849,000,000 in the previous peak year 1920, and 42,677,000,000 in the earlier war year 1918.

As an indication of the transportation service rendered by the railroads in directly furthering the war effort, they handled for the Army alone, during the three years from "Pearl Harbor" to the end of 1944, a total of 28,000,000 men in organized troop movements and 225,000,000 tons of freight and express. During 1940 they unloaded at American ports for export a total of 818,000 carloads, which increased progressively through 1941, 42 and 43 to a total of 1,462,000 carloads in 1943. In the first 11 months of 1944, the total cars unloaded at American ports had already reached 1,745,000, or more than for the entire year 1943.

As in the volume of service rendered, never before have the railways demonstrated greater efficiency in the handling of traffic, as is evidenced in the following comparisons of performance in the first ten months of 1944 with that of previous calendar years.

Gross ton-miles per freight train-hour averaged 37,548, compared with 35,968 in 1943 and 32,808 in 1939, an improvement of 14.4 per cent during the present war period.

The average daily mileage per active freight locomotive reached 123.5 miles, a slight decrease from the 124.5 miles reached in 1943, but an increase of 18.8 per cent over that in the prewar year 1939. Corresponding figures for active passenger locomotives were 222.2 miles in 1944, compared with 220.9 miles in 1943, and 184.2 miles in 1939, an increase of 20.6 per cent during the current war period. At the same time, freight car mileage per day increased from 40.6 miles in 1939 to 52.0 miles in 1943, to a new high of 52.8 in 1944, the 1944 performance representing a gain of 30 per cent during the last five years.

These are but a few of the records being made on the home front by an industry which only a few years ago was being called decrepit and outmoded. And not to be overlooked or forgotten are the even more outstanding records that are being made by railway men, by railway equipment and by railway materials on our fighting fronts around the world. Truly, the railways are making history.

The Year 1944—

In Construction and Maintenance

THOSE in the construction and maintenance departments of the railways may well look back on the year that has just passed with a sigh of relief. For officers and their men alike, it was a year of exacting demands and many difficulties—demands for urgently needed facilities and a standard of maintenance adequate to the peak war-time traffic which prevailed, and difficulties arising from the inadequacy of all three essentials to construction and maintenance—materials, equipment and man-power, not to mention the added difficulties occasioned by the character and density of the traffic handled. At the same time, 1944 was a year of outstanding achievements, in which the goal of adequate war-time transportation—and especially that relating directly to the war effort—was reached. In that, every one who had a part can be justly proud. And not only that, for every one who had a part can face the year ahead—another of exacting demands and difficulties—with greater confidence.

Construction Largely for War Needs

Looking first at 1944 from the standpoint of construction, it can be said that to an extent greater than in any year since the start of the present conflict, the character of railway construction was influenced by the war and its particular and changing demands on transportation facilities. Almost to the project, due largely to shortages existing in many essential materials, each project undertaken was approved only in the light of its contribution to the safety and adequacy of war transportation facilities.

Thus, as for several years in the past, there was an increasing tendency to put aside other types of construction in favor of those projects that affect more directly the assembly and dispatch of trains, the servicing and repair of locomotives to increase their availabliity for movement over the roads, and the conditioning or reconditioning on all classes of rolling stock. In pursuance of these objectives, much attention during the year was given to the enlargement of yards and to the construction of new yards. Projects in this category, involving total expenditures approximating $20,000,000, were either under way or completed during the year, with the cost of individual projects ranging from less than $100,000 to more than $1,500,000. Likewise, engine terminal projects totaling almost $10,000,000 and locomotive and car shop projects costing a like sum, were completed or nearing completion at the end of the year.

Supplementing these types of projects, many others designed to expedite the movement of trains on the road, including the installation of automatic block signals, of centralized traffic control, of new interlockings or the replacement or rearrangement of existing ones, and the construction, extension or rearrangement of passing sidings, were undertaken during the year, at a combined estimated cost of approximately $20,000,000. No important new lines were completed during 1944, although the new line mileage constructed totalled 121 miles. New multiple-track construction included 61.24 miles of second track, 15.07 miles of third track and 0.23 miles of fourth track.

During the year, as might be expected, the construction of tracks to serve training camps, munition factories and other war industries, as well as other war facilities, fell off still further from the reduced activities of 1943.

Taken as a whole, the volume of railway construction in 1944 was far less than had been hoped for at the beginning of the year, reaching an estimated total of only approximately $450,000,000. While this level of activity is considerably higher than that which prevailed during the 'thirties, the average annual expenditures during the eleven-year period ending with 1941 being only $159,833,636, it was still far short of the level attained during the five years, 1926 through 1930, immediately preceding the depression, which averaged $801,926,000 annually.

In the light of these figures, and the special or select character of the war-time projects undertaken to the neglect of thousands of others, together with the growing obsolescence of many essential facilities, it is evident that the railways are building up a huge backlog of important improvement work that must be started just as soon as conditions will permit. Combine with this the further improvements which will be necessary after the war to reduce the costs of operation while at the same time improve the service to both shippers and the traveling public in the face of severe competition, and one can begin to visualize the magnitude of the post-war construction programs that will be essential if the railways are to retain a favorable position in transportation.

Maintenance, An Up-Hill Fight

The outstanding fact concerning the maintenance of way and structures in 1944 is that, during the year, expenditures for these classes of work rose to a new all-time high. Based on expenditures for the first ten months of the year, it is estimated that the total expenditures of the Class I railways for maintenance of way and structures for the entire year amounted to $1,330,000,000. This is $222,000,000 or 20 per cent higher than the comparable figure for 1943, the previous record, is nearly three times the expenditures for 1939, and is slightly more than four times the amount that was spent for these purposes in 1933. The expenditures for 1944 even out-stripped those of the "boom" period of the 'twenties, being about one and one-half times the average annual expenditures for the period 1925 to 1929, inclusive.

Such large expenditures as were made for maintenance in 1944 are bound to be impressive. That they represent a large volume of work, no one questions. But to assume that the relationship between the expenditures for maintenance in that year and those for similar purposes in previous years gives a reliable gage of the amount of effective work done in 1944 over the earlier years, is seriously misleading. Every maintenance officer knows of the many influences that have been at work, especially during the last two years, which, individually and collectively, have had the effect of reducing materially the volume of effective work performed per dollar expended. In fact, many of them have witnessed their unit costs more than double generally during recent years and rise to three to four times what they were only a few years ago, in view of which they are not misled as to the amount of effective work done during the last year, peak expenditures to the contrary. The fact is, that they know that under the heavy traffic and service requirements of recent years, the generally unbalanced programs of work they have necessarily carried out, and the generally less experience and effectiveness of their labor, a large part of the fixed properties has barely held its own under the most favorable conditions, and a still larger part is showing progressive deterioration.

Rail Inadequate

At no time since the onset of the war have the railways been able to secure what they have estimated as their minimum requirements for rail, one of the most basic elements of the track structure, and the year 1944 was no exception. In 1942 they placed their minimum

needs at 1,632,000 net tons, and received only 1,192,225 tons. In 1943 they asked for 2,100,000 tons and were allotted 1,527,000 net tons, of which they were able to lay only approximately 1,262,550 net tons. For 1944, in the face of the deficiencies in the two earlier years, the railways estimated their minimum requirements at nearly 2,600,000 net tons, but the request of the Office of Defense Transportation to the War Production Board was for only 2,200,000 tons, and because of military demands on the mills for plates and shells and for rail for shipment overseas, the amount of rail made available to the railways was only 1,874,000 net tons, or 726,000 tons less than the quantity that was fixed as the minimum needed.

For 1945, the roads estimated their rail requirements at approximately 2,900,000 net tons. In the face of this, the ODT requested 600,000 tons for the first quarter, and the WPB has allotted only 507,000 tons, as the maximum that can be made available. This can mean only one thing under present peak traffic conditions—further deterioration of a rail situation that is none too good in general, and which is raising concern in some quarters.

Tie Replacements Up, But—

Tie replacements in 1944 were above those for the previous year, reaching an estimated total of approximately 48,500,000 compared with a total of 45,439,512 in 1943, and representing the largest number of replacements in any year since 1931, with the single exception of 1942, when renewals reached 48,616,228. That the roads were able to secure and insert this many ties, in the face of the difficulties that have been experienced by the tie producers during the last two years, and their own labor shortages, is an achievement of no small magnitude, but large as the figure is, many roads were unable to meet their requirements and, generally, it may be questioned seriously whether the renewal rate as a whole was sufficient to compensate for the increased rate at which ties are being worn out under the impact of present-day traffic.

Furthermore, it is a question of serious doubt whether this situation can be improved in 1945, in spite of the strenuous efforts of the tie producers during the last year to build up tie stock for 1945 renewals, because even if the ties should be on hand, it might be impossible for the limited track forces to increase the number of insertions.

Labor Shortage Continues

The inadequacy in the amount of maintenance labor, and the inexperience and reduced effectiveness of much of that labor that was available, were among the most serious contributing factors to the amount of effective maintenance work the roads were able to carry out in 1944, and the same factors promise to be equally serious in the year ahead. As to shortages reported by the roads, the situation late in the year was somewhat improved over what it was a year earlier, when the reported needs were for approximately 54,000 maintenance department men, but that the situation as a whole was little less serious is seen in the fact that the railways were still in need of approximately 38,800 men on November 1, with the expectation that this number will rise sharply with the beginning of the 1945 working season.

In the face of recent unfavorable developments on the Western front, with their urgent impact on the home front for greater war production and added military personnel—requirements which must be met at all costs—the outlook for adequate maintenance labor in the year ahead is none too good. In fact, the situation in 1945 may well become the most serious for the war period to date, unless every road, difficulties and prejudices toward certain types of labor to the contrary, takes advantage of every opportunity to increase its working forces as necessary.

At the same time, and to an extent never attained before, maintenance officers should look to their needs for additional labor-aiding units of work equipment, and to the effective utilization and maintenance of every unit of such equipment on hand. What such equipment has contributed to the outstanding accomplishments of the maintenance of way and structures forces in recent years is pointed out in the leading article of this issue, which also details the record-breaking purchases of the various roads during 1944, despite the restrictions and difficulties involved in the production and acquisition of this equipment. Suffice it here to say, as is recognized by every maintenance officer, that if it had not been for the increased production in maintenance work during the last three years made possible by power tools and machines, on hand and newly acquired, the tracks and structures today might well be the limiting factor in the war transportation effort of the country, with no chance of even holding their own in the year ahead.

A Tough Year Ahead

At best, 1945 promises to be a tough year for maintenance officers; possibly tougher than any of the war years to date. They will continue to be short of nearly all of their essential requirements in materials, equipment and man-power, and in the face of what may prove to be still more exacting demands upon their facilities. However, with the stakes so high, is there one of them who will not rise to the challenge, who has not already in the New Year re-dedicated his best effort to the job to be done—that must be done—despite difficulties, if the railways are to continue to contribute their indispensable part to the war effort of the country in its hour of crisis?

Index Reminder—

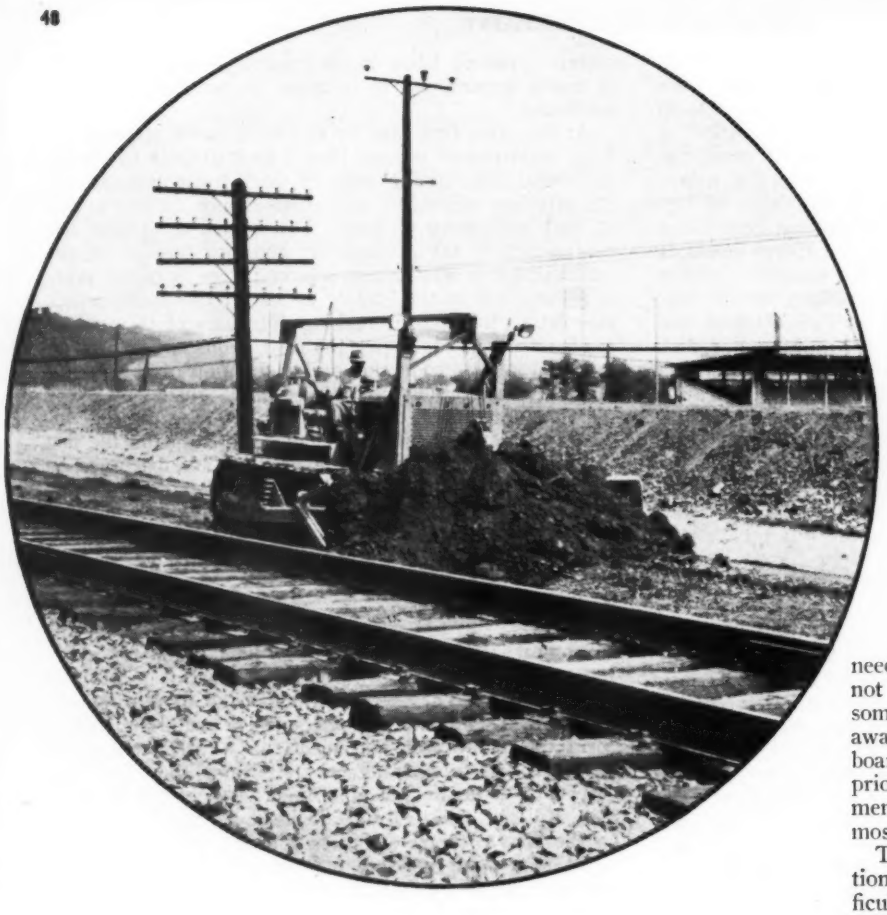
If You Desire One, Be Sure To Ask For It

As announced in the last issue, the annual index of *Railway Engineering and Maintenance* for 1944, although it has been prepared, is not, as in the past, being mailed to all subscribers as a part of the January issue. The reason for this is the serious paper shortage now prevailing and the consequent necessity of conserving paper in every way possible as one means of furthering the war effort.

However, sufficient copies of the index have been printed to meet the needs of all subscribers who may desire to have them. To obtain a copy, just write to H. E. McCandless, circulation manager, 30 Church Street, New York 7, N.Y.

We recognize that the necessity of requesting the index will be an inconvenience to those who will want them, but we are sure that this inconvenience will not be too great a burden when measured against the fact that the paper saved by not printing unnecessary copies of the index is in the interest of the war effort, and will enable us to include more pages in the regular issues.

Railways



Large Quantities of Earth-Moving Equipment of Many Types Were Purchased in 1944

FACED with a continuing shortage of labor, which grew more acute as the year advanced, while at the same time striving to meet a growing demand for more and better maintenance to insure against delays to or interruptions of an extraordinary volume of the most vital traffic the railways have ever carried, almost with one accord maintenance officers have been constrained to turn to work equipment as the only solution of the problem of how to do more work with fewer men. As a result of this situation, the railways purchased last year the unprecedented number of 9,984 power machines and tools, a volume of equipment never before equalled, and almost 1,500 units more than the previous record, the nearest approach to this figure having been in 1943, when 8,507 units were purchased.

Turn to Power Machines

Added to the inability to hire additional men, maintenance officers found an added incentive for turning to power machines as aids to the force they were able to employ, in the fact that this force was less effective than normal, because most of the men who have remained in service, as well as many of those who have been hired during the last three or four years, are in the older-age brackets and are, therefore, unable to accomplish as much work as the younger men who formerly made up a large part of these forces.

It is not debatable that with more work and fewer men, there was no alternative other than further mechanization of maintenance operations as an offset to the extreme lack of needed labor. In this situation it was indeed fortunate that the railways had bought work equipment freely during each of the last four preceding years, and that they thus already possessed a considerable number of power machines and tools, although, as has been pointed out repeatedly in these columns, no road has at any time had sufficient work equipment to meet its needs, even in normal times.

Although the War Production Board has never given the railways a military status with respect to the procurement of materials, it has recognized the importance of providing power machines and tools to overcome a situation of which it was fully aware, as it was equally cognizant of the dire effect of a breakdown in the maintenance of railway facilities. On their own part, the railways were able to present their needs so convincingly that, although not all requirements were met, and some orders were delayed seriously awaiting the necessary priorities, the board was inclined to be helpful and priorities were issued for the equipment that was considered to be needed most seriously.

There have been numerous indications that labor will be still more difficult to obtain in 1945 than it was in 1944, and these indications have become more evident recently as a result of the efforts of the War Manpower Commission to take men out of non-essential industries and channel them into essential war jobs. They have also been brought into bolder relief by the difficulties in which we now find ourselves along the Western front in Europe.

Still Do Not Have Enough

It seems evident, therefore, that the railways will need as much, or more, new work equipment in 1945 as they purchased in 1944, in part to replace equipment that has been used so intensively that it must be retired, and in part to offset the still more inadequate forces that will be available during the year. In confirmation of this prediction, although many of the work-equipment budgets for next year have not yet been completed, enough of them have been approved to show that the railways as a whole are planning to buy more power machines and tools next year than they did in 1944.

As training camps, munition plants, arsenals and other military establishments and war industries were completed many contractors were left with used equipment on their hands, for which they had no immediate need.

Spent $14,400,000 for WORK EQUIPMENT in 1944

Under the Pressure of Necessity and Despite a Continuation of the Severe Restrictions that Affect the Procurement of Materials, 157 Roads Purchased 9,984 Power Machines and Power Tools in 1944. Budgets for 1945 Call for Still More

The result was that, in 1943, relatively large purchases were made of second-hand equipment and a small amount of such equipment was also purchased in 1944, where new equipment of the desired types was not otherwise available.

These transactions were generally profitable to the railways, although all of the equipment had been used intensively, and much of it had suffered considerable abuse. With the close of the war, it is quite probable that the army will be in possession of a great deal of similar equipment and the railways may be solicited to purchase a considerable amount of it. They should approach the matter of making such purchases with a great deal of caution, however, for a large part of this equipment has been handled by inexperienced operators under conditions that were generally conducive to abuse and inadequate maintenance.

Following the trend that first became apparent in 1942, and which became a feature of the purchases of work equipment in 1943, a further study of the detailed lists of purchases by individual roads, which follows this discussion, will disclose that, in general, purchases again were confined to those types that can be substituted in largest measure for hand labor and those, such as cranes, pile drivers, snow plows and wrecking derricks, which perform tasks that cannot be done manually. In addition, however, many other types that are helpful in assisting the men actually employed to get greater production or do their work better or with less effort, were also purchased, as is indicated by the fact that 149 different types are included in these lists, compared with 133 types in 1943.

Obviously, taken by itself, the purchase of 9,984 units of work equipment in any year would be a matter of more than passing interest to manufacturers and railways alike, and to those who are interested in the economics of transportation. However, purchases of this magnitude become still more impressive when it is recalled that in the seven years immediately preceding 1944, a total of 37,773 power machines and tools were purchased at a cost of $53,500,000, and that the purchases in 1944 bring this total to $57,900,000.

Most Were Additions

It should be kept in mind, however, that not all of these machines were intended as additions to the equipment already owned, for many of them were obtained for the purpose of replacing units that had become obsolete or worn out by the intensive use to which they have been subjected. On the other hand, many of those that were acquired in 1944 were primarily as additions to offset the lack of labor, rather than for replacements, for only those machines were retired that could not be reconditioned to be continued in service, or that could not be operated without hazard. On this basis, it is estimated that the purchases made in 1944 bring the total railway investment in work equipment to about $130,000,000.

No discussion of work equipment would be completed without considering the expansion of its use, for one of the important features that has always characterized both the production and use of power machines and power tools, and which has exerted a powerful influence on this expansion, is the manner in which manufacturers have striven constantly to improve their machines, both physically to increase their dependability and to facilitate their maintenance, and from the standpoint of operation to increase their efficiency and to make operation easier. They have also striven equally to provide new machines to perform operations that were still performed manually, and to produce new designs that were better adapted to do the work for which they were intended.

In addition, they have striven to adapt their machines to the new conditions that are constantly arising in maintenance. The results of these continuing efforts on the part of manufacturers are apparent in the number of machines and tools that have been redesigned in whole or in part in recent years, and in the equally important improvements that have been made in others. While much of this activity has, of necessity, now been suspended, partly because of prevailing restrictions on materials, and partly because most manufacturers of railway supplies are largely preoccupied with war work, both manufacturers and maintenance officers have been alert to note the possibilities for improvements, and it may be expected that when the war ceases, this progress in development will be resumed at an accelerated rate.

Source of Information

To obtain the information that is given in detail on the following pages, inquiry was made of all of the railways in the United States, Canada and Mexico concerning their purchases of work equipment. Replies were received from 437 roads, representing 78 per cent of all of the railways in these three countries, and including all but two of the Class I roads in the United States and one in Canada. Of this number, 157 roads reported purchases of work equipment, an increase of 24 over the number that reported purchases in 1943. It is obvious that if reports had been received from the three roads mentioned, the total purchases reported would have gone well beyond 10,000 units, for all three of them have pur-

chased work equipment freely in the past.

For many years after work equipment had established itself and was being recognized as necessary to adequate maintenance, obsolescence had no place in the thinking of maintenance officers; in fact, few of them understood its importance or even what the term implied. As a result, it was not considered as a possible reason for the retirement of a power machine or a power tool, for once a machine or a tool was acquired, it was used until it was so worn that it was unfit for further service.

The reason for this is not far to seek, since the amount of work equipment in service was so completely inadequate that efficiency was not a factor in considering its retirement, and any new units that could be obtained were rated as additions. Today, obsolescence is again being disregarded because it is essential to keep every unit of equipment in service as long as it can be used effectively and safely to perform the work that is so necessary, regardless of any considerations of economy. It may be expected, therefore, that in the postwar period, as conditions revert to normal, there will be an upsurge of retirements that are now being held in abeyance as a matter of necessity.

Among the striking examples of the purchases of work equipment is the number of motor cars that are purchased every year. Some manufacturers have expressed the fear that at the rate the railways have been purchasing work equipment during the last four or five years, the saturation point for certain types will soon be reached and that the market will then be closed for these types, or that the demand for them will be so restricted that there will be no incentive to continue their manufacture. That these fears are groundless is demonstrated by motor cars, more of which are bought every year than any other type of equipment, despite the fact that they represent the only type that is in universal use.

Under these circumstances it is obvious that all of the motor cars that are purchased year by year are for replacement only, except for a negligible number of inspection cars and a few heavy-duty cars for the use of large gangs. It is of special interest, therefore, that the purchases of motor cars in 1944 aggregated 3,131, or only 108 less than the all-time record of 3,239 cars that were purchased in 1943. In addition, 1,374 push cars and motor-car trailers were purchased last year, compared with 1,130 in 1943 and 1,069 in 1942.

No other type of equipment has progressed so far along the way toward the point of saturation as tie tampers, although they are still far from this goal. Yet they provide almost as good an example as motor cars of the continuing need for mechanical aids in maintenance, for this equipment has now been in use for more than a quarter century and has been used more widely than any other type except motor cars. Furthermore, the value of tie tamping equipment in track maintenance has been demonstrated so clearly that all but a few minor roads have bought liberally of this equipment during the last few years, while purchases have been expanded greatly since the unit tamper and the smaller four-tool outfits, both suitable for use by section gangs, became available. Previously, the only outfits that were available were so large and heavy that they were for use by large gangs only, which greatly retarded expansion of their use.

Yet the fact that purchases of this equipment in 1944 amounted to 478 complete tie-tamping outfits, ranging in size from 4 to 16 tools, and 544 unit tampers, is a clear indication that the point of saturation for this equipment has not yet been approached closely. This is confirmed further by the fact that tie tampers have a large place in those budgets for 1945 that have been completed.

Power Plants and Grading Units

Tie-tamping outfits, welding outfits, paint-spraying outfits and portable electric-lighting plants include the power plants necessary for their operation. In addition, however, the railways purchase year by year, independently of such outfits, a large number of air compressors and generators, some of which are intended for the replacement of worn-out units. However, the majority of these independent units are evidently purchased for the express purpose of extending the use of small portable power tools, used principally by bridge and building gangs. This is indicated by the large number of these tools that are purchased each year. In 1944, in continuation of this trend, the railways purchased 67 air compressors and 85 generators.

For the fifth consecutive year, the railways gave indication that they were continuing their awakened interest in earth-moving equipment by making liberal purchases of units falling within this classification, to an aggregate of 249. These purchases demonstrate a determination to continue the work of strengthening the roadbed by widening embankments and through better drainage, as well as to smooth the right of way so that it can be policed more easily.

This was 84 more units of grading equipment than were purchased in 1943. Included in this total were 89 tractors, 44 angle dozers and bulldozers, 11 draglines, 16 power shovels, 6 spreader-ditchers and 58 buckets of various types for excavating. Other units in this classification included sheepsfoot rollers, road rollers, front-end loaders, carryalls, motor trucks, dump wagons, wagon scrapers, roadbed shapers and ditching machines. As might have been expected in view of the present density and speed of traffic, all of the mobile units were of off-track designs, except spreader-ditchers and ditching machines.

Among the important maintenance tasks of the year was the installation of approximately 1,600,000 tons of rail, and the laying in secondary lines of a large part of the rail thus released. In preparation for this work, 1,188 units of rail-laying equipment were purchased, more than double the 513 units of similar equipment that were purchased in 1943. These purchases included spike pullers, bolt tighteners, adzing machines, creosote sprayers, rail cranes, spike drivers, rail and bonding drills, and rail grinders.

Although less ballast was applied in 1944 than was expected at the beginning of the year, largely because of the labor shortage, this feature of maintenance was by no means neglected, for, in addition to that relayed with new and released rail, many miles of track were given a general surface. For this work, in addition to the tie-tamping equipment that has been mentioned, the railways purchased 51 units of surfacing equipment, including ballast cleaners, power ballasters and power jacks, the largest number of these items ever to be purchased in a single year.

Better Policing in 1944

Usually, in times of labor shortages, one of the first items to be neglected is the policing of station grounds and the right of way. However, the present generation of maintenance officers has a vivid recollection of the appearance of the track, of the right of way and of station grounds during the depth of the depression, and of the task involved in cleaning them up after increased revenues made it possible to do so, and these officers look upon weed destruction as one of the important items of a maintenance program. To avoid a repetition of this experience and to continue the work of policing the property, as has been done consistently for several years, the railways purchased 333 units of weed-destroying equipment in 1944, compared with 137 in 1943. Included in

As in Previous Years, Much Equipment of Various Types Was Ordered to Speed Up Rail Laying Operations and Improve the Quality of Work Done

these purchases were discers and scarifiers, extenguisher cars, rail-mounted mowers, tractor mowers, hand-guided power mowers, weed burners and weed sprayers.

Owing to the unusual density of traffic on main-line tracks and the almost complete curtailment of local passenger traffic, much difficulty is being experienced in the transportation of both men and materials for making repairs to buildings and water-service facilities. Because of these difficulties and the ensuing delays to the work and loss of time by the men, many roads have found it necessary to handle both men and materials by highway. Despite the restrictions that have been placed on the manufacture and purchase of highway vehicles, the railways were able to make a sufficiently strong showing of their needs to obtain 364 highway vehicles in 1944, compared with 273 in 1943. These vehicles included 65 automobiles, station wagons and buses, 296 motor trucks and 1 highway trailer.

The number of general-purpose or roustabout and locomotive cranes purchased in 1944 registered a considerable increase over the number purchased in 1943. In addition to the rail cranes, which have already been mentioned in connection with rail-laying equipment, 42 cranes of other types were purchased, which, together with the 34 rail cranes that were purchased last year, makes a total of 76, compared with 61 in 1943. In addition to these, however, 66 derrick cars, 2 truck-mounted cranes and 2 wrecking cranes were purchased.

Many other purchases, which cannot be mentioned in detail, were made in 1944. These include 35 concrete mixers, 4 concrete vibrators, 31 paint-spraying outfits, 111 portable pumps, 632 rail and flange lubricators, 6,806 switch heaters, 130 rail saws, 81 timber saws, 4 track-mounted snow plows, 12 tractor-mounted snow plows, 11 truck mounted snow plows, 5 snow sweepers, 87 tie borers, 8 tie pullers, 45 welding outfits and 57 wood borers. It should be noted that the switch heaters are not included in the 9,984 units that are listed.

The first record of work equipment purchases was made for 1937, so that a review of the purchases for this and the seven succeeding years should be of interest as showing the extent of the expansion that has occurred in the use of this equipment since that date. The number of units purchased year by year from 1937 to 1944, both inclusive, is as follows: 1937, 3,310 units; 1938, 1,376 units; 1939, 3,547 units; 1940, 5,414 units; 1941, 8,007 units; 1942, 7,612 units; 1943, 8,507 units; and 1944, 9,984 units. Thus, a total of 47,757 units of work equipment, not including switch heaters, have been purchased during the last eight years at a total cost of $67,900,000, bringing the total investment in this class of equipment to approximately $130,000,000.

Among the outstanding information divulged by the foregoing figures is that there is a growing appreciation of the value of work equipment for maintenance tasks, and that this appreciation has been greatly stimulated by the shortage of labor with which maintenance officers are now contending. The effect of the lessons learned during the lean years of the early 'thirties are reflected in the purchases for both 1943 and 1944, and this gives a clearer understanding of the determination of the railways to purchase still more liberally in 1945 than they have done in any previous year, in the expectation that in 1945 the labor situation will be still more difficult than in any year to date.

A detailed list of the work equipment purchased in 1944, by all of the railways in the United States, Canada and Mexico, except the three that have already been mentioned, follows:

UNITED STATES

Akron, Canton & Youngstown
- 2 Motor cars, section
- 1 Motor car, heavy duty
- 1 Motor car engine
- 1 Motor car frame
- 6 Push cars
- 6 Tie tampers, unit type

Alaska
- 5 Motor cars, inspection
- 2 Rivet cutters

Alton
- 1 Adzing machines
- 1 Air compressor
- 2 Bolt tighteners
- 1 Car, dump
- 1 Grinder, rail mounted
- 5 Motor cars, inspection
- 11 Motor cars, section
- 3 Motor cars, heavy duty
- 1 Pump, sump
- 1 Pump, portable
- 2 Push cars
- 2 Spike drivers
- 8 Tie pullers

Alton & Southern
- 1 Grinder, rail, portable

Apache
- 1 Motor truck, s.h.

Apalachicola Northern
- 1 Motor car, section

Arcade & Attica
- 1 Welding outfit

Atchison, Topeka & Santa Fe System

A-Atchison, Topeka & Santa Fe
- 15 Adzing machines
- 13 Bolt tighteners

5 Bulldozers
1 Concrete mixer
3 Cranes
3 Creosote spraying outfits
2 Discers
6 Drills, rail
1 Generator, portable
2 Grinders, portable
113 Motor cars
35 Motor car engines
12 Mud jacks
6 Power jacks
250 Push cars
23 Rail and flange lubricators
5 Saws, rail
3 Shovels, power
6 Spike drivers
8 Spike pullers
1 Spreader ditcher
32 Tie tamping outfits
5 Tractors

B-Gulf, Colorado and Santa Fe
1 Bulldozer
1 Creosote spraying outfit
1 Grinder, rail, portable
25 Motor cars
3 Motor car engines
2 Mowing machines
50 Push cars
4 Rail and flange lubricators
1 Saw, rail
2 Tie tamping outfits
1 Tractor

Atlanta & St. Andrews Bay
1 Dragline, s.h.
1 Motor car, inspection
1 Motor car, section
1 Push car
1 Rail laying machine

Atlanta & West Point-Western Railway of Alabama
1 Adzing machine
1 Bolt tightener
1 Generator, portable
1 Motor car, inspection
1 Motor car, heavy duty
6 Motor cars, section
3 Pumps, portable
2 Rail and flange lubricators
3 Tie tamping outfits

Atlanta, Birmingham & Coast
1 Motor car, inspection
10 Motor cars, section
5 Push cars

Atlantic & Carolina
1 Motor car, section

Atlantic & Yadkin
1 Paint spraying outfit

Atlantic Coast Line
2 Adzing machines
1 Ballast cleaner
3 Bolt tighteners
1 Concrete mixer
1 Crane, rail
1 Creosote sprayer
1 Drill, rail
2 Rail bender
4 Spike drivers
2 Spike pullers
16 Tie tampers, unit type
1 Welding outfit

Bangor & Aroostook
1 Bucket, clamshell
1 Discer attachment
1 Grinder, rail mounted — accessories only
3 Motor cars, inspection
14 Motor cars, section
1 Wrench, power

Belfast & Moosehead Lake
1 Motor car, section

Bellefonte Central
1 Air compressor

Bessemer & Lake Erie
1 Automobile, carry-all s.h.
1 Motor car, inspection
1 Tie tamping outfit

Bingham & Garfield
1 Derrick car
4 Rail and flange lubricators

Blue Ridge
1 Derrick car
1 Motor car, inspection
2 Motor cars, section

Boston & Maine
1 Adzing machine
4 Air compressors
3 Bolt tighteners
9 Buckets, clamshell
2 Cranes
2 Discers
15 Drills, portable
12 Drills, bonding
4 Drills, rail
1 Grinder, rail, portable
5 Grinders, pneumatic
12 Hammers, chipping
3 Hammers, riveting
8 Jackhammers
20 Motor cars, inspection
20 Motor cars, heavy duty
12 Paint spray guns
10 Paving breakers
4 Pumps, portable
2 Rivet cutters
4 Saws, chain
7 Saws, portable
5 Saws, rail
1 Snow plow, single track
1 Snow plow, double track
3 Snow plows, tractor mounted
11 Snow plows, motor truck mounted
5 Snow sweepers, tractor mounted
10 Spike drivers
1 Spike pullers
56 Tie tampers, unit type
20 Tie tamping outfits
6 Wood borers

Canton
1 Automobile
2 Buckets, clamshell
1 Bulldozer
2 Cranes, Diesel locomotive
1 Grinder, rail mounted
2 Tie tamping outfits
1 Tractor

Cape Fear Railways, Inc.
1 Motor car, section
1 Tie tamping outfit

Central Indiana
2 Motor cars, section

Central of Georgia
3 Adzing machines
5 Bolt tighteners
2 Drills, rail
1 Jack, power
4 Motor cars, inspection
3 Motor cars, section
3 Motor trucks
2 Paint spraying outfits
2 Rail and flange lubricators
2 Rail laying machines
1 Saw, power hack
1 Saw, rail
7 Tie tamping outfits

Central of New Jersey
1 Drill, rail
2 Dump bodies for truck mounting
1 Expanding root cutter
2 Manhole jacks
12 Motor cars, heavy duty
2 Motor car turntables
6 Motor trucks
1 Pipe pusher
1 Pump, portable
6 Push cars
1 Saw, timber
1 Saw, rail
1 Spreader ditcher
2 Windlasses, sewer cleaning

Charleston & Western Carolina
1 Bolt tightener
1 Crane
2 Drills, rail
15 Rail and flange lubricators

Chesapeake & Ohio
2 Adzing machines
1 Air compressor
3 Automobiles
2 Ballast cleaners
10 Bolt tighteners
1 Bulldozer
2 Buses
2 Cranes, rail
1 Drill, bonding
2 Grinders, rail mounted
9 Grinders, portable
75 Motor cars, inspection
56 Motor cars, section
9 Motor cars, heavy duty
3 Motor trucks
2 Paving breakers
2 Pumps, portable
30 Push cars
22 Rail and flange lubricators
7 Tie borers
2 Tie tamping outfits
1 Tractor
2 Welding outfits
2 Wrenches, impact
35 Wrenches, power

Chicago & Eastern Illinois
3 Adzing machines
1 Ballast cleaner
2 Bolt tighteners
1 Bulldozer
1 Concrete breaker
1 Creosote sprayer
1 Grinder, tie adzer bits
1 Sheepsfoot roller
2 Spike drivers
2 Spike pullers
2 Tie tamping outfits
1 Tractor and accessories
1 Weed burner

Chicago & Illinois Midland
1 Adzing machine
1 Bolt tightener
1 Grinder, rail, portable
1 Motor truck
6 Pumps, portable
1 Spike driver
1 Spike puller

Chicago & Western Indiana
1 Motor car, inspection
3 Rail and flange lubricators

Chicago, Burlington & Quincy System

A-Chicago, Burlington & Quincy
1 Adzing machine
1 Air compressor
1 Ballast cleaner
3 Bolt tighteners
7 Buckets, clamshell
1 Bucket, dragline
7 Cars, derrick
6 Concrete mixers
7 Cranes, locomotive, rail mounted Diesel powered
3 Discers
9 Demolition tools
1 Dragline s. h.
7 Drills, portable
2 Drills, rail
1 Generator, portable
1 Grinder, rail, rail mounted
2 Grout mixers and placers
6 Hammers, riveting
2 Hoists, air
3 Jacks, bridge 50 ton
7 Jacks, power
35 Motor cars, inspection
187 Motor cars, section

1 Motor car, heavy duty
7 Mowing machines, rail mounted
6 Mowers, tractor mounted
3 Paint spraying outfits
20 Pumps, portable
6 Rail and flange lubricators
7 Saws, timber
1 Saw, rail
33 Scythes, motor
2 Spreader-ditchers
4 Tie tampers, unit type
40 Tie tamping outfits
5 Tractors and accessories
2 Welding outfits
1 Winch, tractor mounted
12 Wood borers
4 Wrenches, impact

B-Colorado & Southern

1 Adzing machine
2 Air compressors
1 Automobile
1 Angle dozer
1 Bolt tightener (for track bolts)
1 Bucket, clamshell
1 Bull clam shovel
1 Crane, rail
1 Crane, locomotive, Diesel powered
1 Cross grinder, rail
1 Grinder, rail portable
4 Motor cars, inspection
17 Motor cars, section
6 Motor trucks
2 Mowers, rail mounted
2 Push cars
2 Saws, timber
3 Tractors
1 Weed burner

C-Ft. Worth & Denver City

1 Adzing machine
1 Bolt tightener
1 Bull clam shovel
1 Crane, locomotive, Diesel powered
1 Crane, rail
1 Drill, portable
1 Magnet, lifting
12 Motor cars, inspection
20 Motor cars, section
3 Motor cars, heavy duty
2 Mowing machines, track mounted
2 Push cars
1 Tractor
2 Trailers

Chicago Great Western

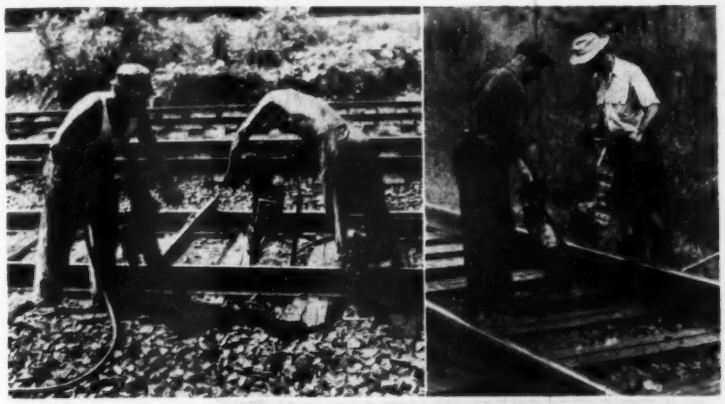
1 Bolt tightener
3 Motor cars, inspection
8 Motor cars, section

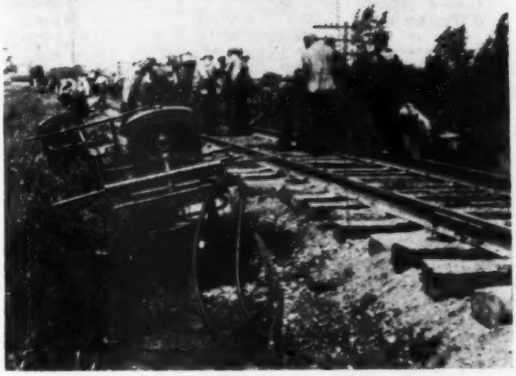
Chicago, Milwaukee, St. Paul & Pacific

3 Air compressors
2 Angle dozers
10 Bolt tighteners
1 Crane, locomotive
5 Drills, rail
2 Front end loaders
30 Motor cars, inspection
150 Motor cars, section
20 Motor cars, heavy duty
10 Mowing machines, tractor mounted
3 Saws, rail
4 Shovels, power
2 Spike pullers
8 Tie tamping outfits
4 Tractors
3 Weed burners
2 Wrenches, impact

Chicago, Rock Island & Pacific

2 Adzing machines
1 Air compressor
6 Concrete breakers
1 Crane, rail
2 Drills, rail
3 Generators, portable
1 Grinder, rail, portable
106 Motor cars
8 Motor trucks
2 Mowing machines, track mounted
5 Mowing machines, tractor mounted
1 Mud jack





Much Tamping Equipment Was Purchased, Particularly Unit Tampers and Outfits with Off-Track Power Units

3 Paint spraying outfits
75 Push cars
6 Saws, timber
8 Tie tamping outfits
2 Welding outfits
3 Wrenches, impact

Clinchfield Railroad Company

1 Crane, rail
2 Motor cars, inspection
1 Pump, portable
1 Welding outfit

Columbus & Greenville

1 Motor car, inspection
1 Tie tamping outfit
2 Wrenches, impact

Danville & Western

1 Derrick car

Delaware & Hudson

2 Adzing machines
1 Air compressor
1 Drill, rail
1 Jack, power
18 Motor cars, section
2 Motor trucks
2 Mowing machines
1 Pump, portable
14 Rail and flange lubricators
1 Saw, timber
1 Saw, rail
2 Spike pullers

Denver & Rio Grande Western

2 Bolt tighteners
1 Set bridge and building power tools
1 Bucket, dragline
1 Bulldozer
2 Cars, derrick
1 Concrete mixer
1 Core drill
4 Drills, bonding
2 Drills, rail
1 Generator
12 Motor cars
9 Motor trucks
6 Rail and flange lubricators
36 Tie tampers, unit type
1 Tractor, crawler mounted
4 Tractors, wheel mounted
1 Weed burner
1 Welding outfit

Denver & Salt Lake

1 Generator, portable
4 Motor cars, inspection
2 Motor cars, heavy duty
2 Pumps, portable

Des Moines Union Ry.

1 Drill, rail

Detroit & Toledo Shore Line

1 Motor car, inspection
1 Motor car, section
1 Motor car, heavy duty
1 Motor car engine
1 Push car
5 Tie tampers, unit type

Detroit, Toledo & Ironton

1 Motor car, inspection
2 Motor cars, section
1 Mowing machine
10 Tie tampers, unit type

Duluth & Northeastern

1 Tie tamping outfit

Duluth, Missabe and Iron Range

1 Automobile
2 Bolt tighteners
1 Bucket, clamshell
2 Drills, portable
4 Drills, rail
2 Hammers, riveting
1 Hoist, air
3 Motor cars, inspection
3 Motor cars, heavy duty
2 Paving breakers
2 Saws, rail
1 Saw, timber
1 Spiker puller
5 Tie tamping outfits

East Erie Commercial
1 Derrick car

East Jordan & Southern
1 Motor car, section

Elgin, Joliet & Eastern
1 Air compressor
1 Bolt cutter
1 Bolt tightener
4 Cars, hand
1 Crane
1 Derrick car
2 Drills, rail
3 Grinders, tool
2 Grinders, rail, portable
1 Grinder, surface
10 Motor cars, inspection
3 Motor cars, section
7 Push cars
11 Rail and flange lubricators
1 Saw, timber
4 Trailer cars

Erie
2 Ballast cleaners
5 Bolt tighteners
1 Drill, rail
6 Generators, portable
16 Motor cars, section
20 Motor cars, inspection
6 Motor trucks
1 Paint spraying outfit
1 Power ballaster
19 Push cars
50 Rail and flange lubricators
2 Saws, timber
6 Saws, rail
1 Tie borer
16 Tie tampers, unit type
5 Trailers, motor car
2 Welding outfits

Escanaba & Lake Superior
1 Mowing machine

Florida East Coast
2 Adzing machines
1 Air compressor
1 Generator, portable
5 Hammers, portable
20 Motor cars, section
15 Motor cars, inspection
6 Mowing machines
1 Pump, portable
4 Sanders, heavy duty
2 Spike pullers
1 Tie tamping outfit

Galesburg & Great Eastern
1 Dragline
1 Motor car, section

Galveston Wharves
2 Automobiles
1 Motor truck

Georgia & Florida
1 Motor car, inspection
1 Motor car, heavy duty
5 Motor car engines

Georgia
2 Bolt tighteners
4 Motor cars, section
7 Rail and flange lubricators
1 Tie tamper, unit type
2 Tie tamping outfits
1 Wrench, impact

Great Northern
1 Adzing machine
2 Air compressors
7 Automobiles
6 Bolt tighteners
1 Bucket, clamshell
1 Bucket, dragline
1 Bucket, orange peel
1 Bus
4 Cars, dump
2 Clay diggers
1 Concrete breaker
2 Concrete mixers
1 Concrete vibrator
1 Crane, rail
3 Cranes, crawler mounted
30 Derricks, push car type
1 Detector car
1 Drill, bench
34 Drills, portable
27 Drills, rail
2 Engines, portable
25 Generators, portable
8 Grinders, bench
3 Grinders, portable
1 Hammer, portable
1 Hammer, riveting
7 Hoists, hand
6 Jackhamers
62 Motor cars
62 Motor car engines
62 Motor car frames
37 Motor trucks
7 Mowing machines
1 Mower, tractor mounted
1 Paint spraying outfit
1 Pile driver
1 Pipe pushing machine
8 Pony cars
1 Post hole digger
3 Pumps, portable
2 Rivet cutters
1 Saw filer, portable
14 Saws, portable
3 Saws, rail
2 Shovels, power
3 Snow plows for tractor mounting
2 Spike drivers
14 Tie cutters
23 Tie tamping outfits
4 Tractors
89 Trailers, motor car
16 Weed burners
3 Welding outfits
7 Wood borers
1 Wrench, power

Green Bay & Western
1 Bolt tightener
1 Crane, truck mounted
3 Motor cars, section
3 Motor cars, heavy duty
3 Motor cars, inspection
4 Motor car engines
4 Push cars
2 Trailers, motor car

Gulf, Mobile, & Ohio
3 Motor cars, inspection
20 Motor cars, section
20 Rail and flange lubricators

Illinois Central
5 Air compressors
14 Bolt tighteners
2 Concrete mixers
4 Discers
3 Draglines s.h.
22 Drills, rail
5 Front end loaders
10 Grinders, rail, portable
15 Motor cars, inspection
33 Motor cars, section
4 Motor cars, heavy duty
6 Mowing machines
3 Paint spraying outfits
5 Pumps, portable
40 Rail and flange lubricators
10 Spike drivers
4 Spike pullers
2 Tie cutters
40 Tie tampers, unit type
35 Tie tamping outfits
2 Weed burners

Illinois Terminal
9 Motor cars

Interstate Railroad
1 Motor car, section

Kansas City Southern System
A-Kansas City Southern
2 Adzing machines
1 Drill, rail
1 Motor car, inspection
9 Motor cars, section
1 Motor car, heavy duty
10 Motor car engines
B-Louisiana and Arkansas
1 Discer
3 Motor cars, inspection
3 Mowing machines

Kentucky & Indiana Terminal
2 Air compressors
1 Drill, electric, portable
1 Drill, rail
1 Grinder, electric, bench
3 Motor cars, section
1 Motor car, heavy duty
1 Saw, timber
2 Tie tamping outfits
1 Trailer, highway
4 Trailers, motor car
1 Weed-spraying outfit
1 Welding outfit
1 Wrench, impact

Kentucky & Tennessee
1 Motor car, section

Lake Superior & Ishpeming
2 Drills, electric portable
2 Saws, timber

Lehigh & Hudson River
1 Grinder, rail, portable
4 Motor cars, section
1 Motor truck
1 Mowing machine, rail mounted
3 Push cars
1 Saw, rail

Lehigh & New England
1 Bolt tightener
1 Bucket, clamshell
1 Crane, rail
1 Drill, rail
1 Generator, portable
1 Pump, portable
2 Push cars
1 Rail and flange lubricator

Lehigh Valley
1 Adzing machine
4 Air compressors
4 Ballast cleaners
4 Buckets, clamshell
4 Bolt tighteners
1 Crane, rail
6 Grinders, rail portable
1 Jack, power
72 Motor cars
1 Motor car frame
9 Motor trucks
2 Pumps, portable
21 Push cars
3 Trailers, motor car

Ligonier Valley
1 Motor car, section

Los Angeles Junction Railway
1 Air compressor

Louisville & Nashville
8 Adzing machines
2 Air compressors
3 Bulldozers
1 Drill, bonding
1 Derrick car
20 Grinders, portable
38 Motor cars, inspection
61 Motor cars, section
3 Pumps, portable
3 Scrapers
9 Saws, rail
3 Tractors
1 Welding outfit
7 Wrenches, power

Macon, Dublin & Savannah
1 Derrick car
10 Dump cars, attachments for
1 Saw, chain
6 Trailers, motor car

Maine Central
1 Air compressor
2 Bolt tighteners
1 Bucket, clamshell
2 Concrete mixers
1 Creosote sprayer
8 Drills, rail
2 Drills, portable
5 Grinders, rail portable
11 Motor cars, inspection
9 Motor cars, section
6 Motorcars, heavy duty
3 Motor trucks
5 Paving breakers
1 Pipe cutting machine, portable, power driven
1 Pipe forcing jack
1 Pump, portable
4 Push cars
10 Rail and flange lubricators
1 Rail layer, 3-man power operated
2 Saws, portable
2 Saws, rail
2 Sewer cleaning machines
1 Shovel for mounting on tractor
2 Snow plows, single track
2 Spike drivers
28 Tie tampers, unit type
8 Tie tamping outfits
1 Tractor

Maryland & Pennsylvania
2 Tie tampers, unit type

Massena Terminal
1 Motor car, section
1 Push car

Minneapolis & St. Louis
1 Bolt tightener
1 Motor car, inspection

Minneapolis, St. Paul & Sault Ste. Marie
A-Minneapolis, St. Paul & Sault Ste. Marie
5 Motor cars, inspection
1 Motor car, heavy duty
25 Motor car engines
1 Pump, portable
1 Tractor and accessories
B-Duluth, South Shore & Atlantic
1 Motor car, inspection
1 Motor car, heavy duty
1 Tie tamping outfit

Minnesota Transfer
1 Motor car, heavy duty
1 Weed burner

Mississippi Central Railroad Company
1 Motor car, inspection
2 Motor cars, section
12 Motor car frames
1 Pump, portable

Missouri & Arkansas
1 Automobile
1 Mowing machine
1 Rail and flange lubricator

Missouri-Kansas-Texas
1 Ballast drainage car
1 Concrete mixer
1 Concrete vibrator
4 Drills
1 Grinder, rail, rail mounted
1 Mowing machine
2 Rail laying machines
6 Tie tampers, unit type
1 Welding outfit

Missouri Pacific Lines
A-Missouri Pacific
2 Bulldozers
9 Cars, derrick
4 Concrete breakers
1 Discing and scarifying unit
1 Dragline
1 Drill, rail
60 Motor cars, inspection
33 Motor cars, section
25 Motor cars, heavy duty
5 Motor car frames
29 Mowing machines, tractor type
10 Mowing machines
4 Pole drivers
20 Rail and flange lubricators
50 Tie tampers, unit type
2 Tractors
9 Weed burners
B-Gulf Coast Lines
1 Adzing machine
1 Crane, rail
1 Discer
2 Extinguisher cars
3 Motor trucks
9 Mowing machines
1 Weed burner
C-International-Great Northern
1 Ballast cleaner
1 Bolt tightener
1 Crane, rail
1 Discer
2 Extinguisher cars
1 Motor truck
8 Mowing machines
1 Tractor, shop mule
1 Weed burner
D-Missouri-Illinois
1 Motor car, inspection
1 Motor car, section
2 Motor cars, heavy duty
2 Mowing machines, tractor mounted
1 Weed burner

Monongahela
1 Ballast cleaner with derrick
1 Drill, bonding
1 Motor car, inspection
2 Motor trucks
2 Rail and flange lubricators

Nashville, Chattanooga & St. Louis
2 Adzing machines
1 Car, derrick
6 Concrete mixers
2 Cranes, locomotive
1 Crane, rail
3 Drills, rail
1 Grinder, rail, portable
6 Motor cars, inspection
54 Motor cars, section
1 Paint spraying outfit
2 Rail layers
4 Tie tamping outfits
1 Track laying machine
1 Welding outfit

New York Central Lines
A-New York Central
6 Adzing machines
2 Automobiles
1 Ballast cleaner
1 Ballaster
10 Bolt tighteners
4 Buckets, clamshell
2 Cranes, locomotive
2 Discers
16 Drills, rail
9 Generators, portable
1 Grinder, rail, rail mounted
15 Grinders, rail, portable
1 Jack, power
26 Motor cars, inspection
74 Motor cars, section
54 Motor cars, heavy duty
13 Motor trucks
23 Mowing machines
12 Push cars
12 Rail and flange lubricators
1 Saw, timber
1 Band saw
10 Saws, rail
3 Spike drivers
6 Spike pullers
9 Tie borers
24 Tie tampers, unit type
14 Tie tamping outfits
3 Tractors and accessories
19 Trailers, motor car
3 Welding outfits
12 Wrenches, impact
B-Boston & Albany
4 Adzing machines
1 Bulldozer
1 Crane, rail
2 Drills, portable
2 Grinders, rail, portable
3 Hoists
5 Motor cars, section
4 Motor cars, heavy duty
3 Motor trucks
20 Pneumatic tool oilers
1 Pump, portable
6 Rail and flange lubricators
2 Saws, rail
4 Spike drivers
6 Tie tamping outfits
2 Wood borers
C-Chicago River & Indiana
1 Drill, rail
D-Cleveland, Cincinnati, Chicago & St. Louis
7 Adzing machines
3 Automobiles
1 Ballast cleaner
5 Bulldozers
5 Drills, rail
6 Grinders, rail, rail mounted
10 Grinders, slotting
2 Jacks, power
18 Motor cars, inspection
19 Motor cars, section
21 Motor cars, heavy duty
4 Motor trucks
6 Mowing machines, tractor mounted
6 Saws, rail
1 Spike driver
6 Spike pullers
13 Tie borers
15 Tie tampers, unit type
1 Welding outfit
9 Wrenches, power
E-Indiana Harbor Belt
1 Bolt tightener
2 Drills, rail
F-Michigan Central
7 Adzing machines
3 Automobiles
1 Ballast cleaner
6 Bolt tighteners
4 Buckets, clamshell
1 Bucket, dragline
2 Buses
5 Bulldozers
1 Car, rail highway
3 Cranes, locomotive
1 Crane, rail
2 Discers
2 Drills, rail
4 Drills, portable
2 Generators, portable
8 Grinders, rail, portable
1 Jack, power
2 Lifting magnets
29 Motor cars, inspection
27 Motor cars, section
5 Motor cars, heavy duty
11 Motor trucks
1 Mowing machine, track mounted
12 Mowing machines, tractor mounted
9 Mowers, hand operated, power
2 Pumps, portable
5 Rail and flange lubricators
5 Saws, timber
7 Saws, rail
2 Spike drivers
3 Spike pullers
2 Tie borers
22 Tie tamping outfits
5 Tractors
8 Trailers, motor car
G-Georgia & Eastern
1 Grinder, rail, portable
1 Motor car, inspection
1 Motor car, heavy duty
1 Saw, rail
1 Wrench, power
H-Pittsburgh & Lake Erie
5 Motor cars, heavy duty
1 Tie borer

New York, Chicago & St. Louis
3 Adzing machines

1 Adzing machine bit grinder
1 Bulldozer
1 Bus
1 Concrete mixer
1 Crane, rail
1 Dragline
14 Motor cars, inspection
26 Motor cars, section
3 Motor cars, heavy duty
6 Motor trucks
1 Power jack
1 Sewer cleaning machine
2 Shovel, power
8 Tie tampers, unit type
11 Tie tamping outfits
4 Wrenches, power

New York, New Haven & Hartford

21 Automobiles
12 Motor trucks
88 Rail and flange lubricators
6 Saws, rail
6 Tie borers
10 Tie tampers, unit type

New York, Ontario and Western

1 Car, rail-highway
1 Discer
1 Motor car, inspection
7 Motor cars, section

New York, Susquehanna and Western

3 Motor cars, section

Norfolk & Portsmouth Belt Line

1 Air compressor
1 Motor car, inspection
1 Tie tamping outfit

Norfolk & Western

8 Air compressors
4 Ballast cleaners
7 Bolt tighteners
1 Concrete mixer
2 Cranes, rail
9 Drills, rail
1 Drill, earth
8 Grinders, rail, rail mounted
2 Motor cars, inspection
6 Motor cars, heavy duty
1 Pumpcrete machine
9 Pumps, portable
17 Rail and flange lubricators
1 Road roller
16 Saws, rail
2 Saws, timber
20 Spike drivers
30 Tie tampers, unit type
6 Tie tamping outfits
1 Tractor
5 Wood borers

Pacific Coast

1 Motor car engine

Pennsylvania

6 Adzing machines
1 Air compressor
4 Ballasters, power
1 Ballast cleaner
6 Bolt tighteners
6 Borers, wood
2 Cement guns
3 Concrete breakers
2 Concrete mixers
1 Drill, bonding
2 Drills, rail
6 Dump bodies
2 Earth borers
1 Grinder, electric, portable
12 Grinders, rail
1 Hammer, pile
2 Jacks, power
46 Motor cars
4 Mowing machines, tractor type
1 Pump, portable
2 Rail benders
1 Saw, rail
2 Saws, chain
1 Saw, timber
6 Snow plows, tractor type
22 Spike drivers
20 Tie borers, gasoline-driven
34 Tie tampers, unit type
7 Tractors
2 Trailers, highway
44 Trucks
2 Trucks, tractor type
1 Weed burner
8 Welding outfits
1 Wrench, impact

Peoria & Pekin Union

1 Bulldozer
1 Derrick car
1 Grinder, rail, portable
2 Rail and flange lubricators
2 Tractors
1 Welding outfit

Pere Marquette

2 Adzing machines
5 Bolt tighteners
4 Drills, rail
8 Motor cars, inspection
18 Motor cars, section
8 Motor cars, heavy duty
11 Motor trucks
2 Mowing machines
1 Motor scythe
8 Spike drivers
1 Spike puller
1 Tie borer
12 Tie tampers, unit type
23 Tie tamping outfits
2 Tractors

Pittsburgh & West Virginia

2 Adzing machines
1 Bolt tightener
3 Bridge jacks, power driven, 60 ton
1 Grinder, adzer bit
1 Rail laying machine
1 Saw, timber

Quanah, Acme & Pacific

1 Discer
1 Motor car, heavy duty
1 Motor car engine
1 Weed burner

Reading

1 Adzing machine
4 Bolt tighteners
1 Generator, portable
4 Grinders, rail, portable
1 Motor car, heavy duty
15 Motor cars, section
1 Mowing machine
40 Push cars
4 Rail and flange lubricators
1 Saw, timber
3 Saws, rail
2 Spike pullers
6806 Switch heaters

Richmond, Fredericksburg & Potomac

1 Adzing machine
2 Angle dozers
1 Bolt tightener
1 Drill, rail
13 Motor cars, section
1 Mowing machine, tractor mounted
1 Pump, portable
2 Rail and flange lubricators
1 Saw, chain
1 Saw, circular
2 Tie tamping outfits
2 Tractors
6 Trailers, motor car

St. Johnsbury & Lake Champlain

1 Adzing machine s.h.
1 Crane, rail, s.h.
1 Motor car, section
1 Tie tamper, unit type, s.h.

St. Louis-San Francisco

4 Bolt tighteners
1 Bulldozer
1 Crane, rail
10 Drills, rail
3 Drills, portable
1 Front end loader
3 Generators, portable
18 Motor cars, inspection
9 Motor cars, heavy duty
46 Motor cars, section
15 Motor car engines
5 Motor car frames
47 Rail and flange lubricators
2 Tractors
3 Wrenches, power

St. Louis Southwestern

3 Adzing machines
1 Air compressor
1 Air compressor, crawler mounted
3 Bolt tighteners
1 Concrete vibrator
1 Drill, bonding
10 Drills, portable
2 Drills, rail
2 Generators
5 Grinders, portable
1 Hacksaw, power
1 Hammer, electric
1 Lift truck
8 Motor car, inspection
1 Paving breaker
1 Radiagraph
1 Sander
4 Tie tamping outfits
2 Welding outfits
1 Welding outfit, oxy-acetylene
4 Wrenches, impact
1 Wrench, power

Sand Springs

1 Power mower
1 Pump, centrifugal

Savannah & Atlanta

1 Mowing machine

Seaboard Air Line

6 Adzing machines
1 Air compressor
5 Automobiles
1 Crane, rail
3 Drills, rail
2 Generators, portable
3 Grinders, rail, portable
20 Motor cars, inspection
95 Motor cars, section
16 Motor cars, heavy duty
8 Motor trucks
6 Pumps, portable
6 Rail and flange lubricators
3 Saws, rail
19 Tie tamping outfits
1 Welding outfit

South Georgia

1 Motor car, inspection
1 Motor car engine

Southern System

A-Southern

11 Adzing machines
3 Air compressors
4 Automobiles
6 Ballast cleaners
19 Bolt tighteners
2 Concrete mixers
1 Crane, locomotive
5 Drills, rail
2 Generators, portable
9 Grinders, rail, portable
1 Jack, power
6 Magnets, lifting
103 Motor cars, inspection
103 Motor cars, section
63 Motor cars, heavy duty
34 Motor trucks
4 Mowing machines, tractor mounted
23 Pumps, portable
519 Push cars
30 Rail and flange lubricators
2 Saws, rail
5 Spike pullers
27 Tie borers
5 Tie tampers, unit type
79 Tie tamping outfits
7 Tractors

2 Wagon scrapers

B-Carolina & Northwestern
1 Bolt tightener
1 Derrick car
1 Generator, portable
3 Motor cars, section
3 Rail and flange lubricators

Southern Pacific System

A-Pacific System
4 Adzing machines
5 Air compressors
8 Bolt tighteners
1 Concrete mixer
2 Cranes, rail
4 Electric lighting plants, portable
2 Grinders, rail, rail mounted
12 Grinders, rail, portable
1 Hammer, steam pile
2 Hoists
7 Motor trucks, s.h.
4 Spike pullers
20 Tie tampers, unit type
2 Weed burners
10 Wood borers

B-Lines in Texas & Louisiana
1 Acetylene cutting machine
5 Air compressors
2 Bolt tighteners
3 Buckets, clamshell
1 Bucket, dragline
1 Bulldozer
1 Concrete mixer
3 Cranes, rail
3 Discers
2 Drills, rail
6 Generators, portable
1 Grinder, portable
2 Grinders, rail
1 Hammer, steam pile
68 Motor cars
1 Mower, tractor mounted
1 Paint spraying outfit
1 Pump, portable
5 Push cars, heavy duty
11 Rail and flange lubricators
1 Rock grapple
5 Saws, circular
5 Saws, timber, portable
3 Saws, rail
6 Spike drivers
2 Spike pullers
1 Tie tamper, unit type, combination concrete breaker
25 Tie tamping outfits
2 Tractors
1 Weed burners
2 Winch for tractor, heavy duty
1 Winch for tractor, light
5 Wood borers
1 Wrench, impact
5 Wrenches, power

C-Northwestern Pacific
1 Car, derrick
1 Earth boring machine
2 Generators, portable
2 Jackhamers
9 Motor cars, heavy duty
6 Motor cars, inspection
1 Motor truck
1 Pump, portable
2 Rail and flange lubricators
1 Sander, electric
1 Weed burner
2 Wood borers

D-San Diego & Arizona Eastern
1 Motor car, inspection
4 Motor cars, section
1 Motor, heavy duty
6 Push cars

Spokane International
1 Crane, locomotive
1 Motor car, inspection
1 Mowing machine
1 Tractor

Spokane, Portland & Seattle
1 Adzing machine
4 Automobiles
2 Bolt tighteners
5 Buckets, clamshell
1 Bucket, orange peel
1 Bulldozer
1 Carry-all
4 Cars, air dump
2 Cranes
2 Cranes, rail
2 Cranes, locomotive
1 Crane, wrecking
2 Drills, rail
1 Hammer, steam
18 Motor cars, heavy duty
10 Motor cars, inspection
4 Motor cars, section
2 Motor trucks
1 Pile lead for crane mounting
26 Rail and flange lubricators
2 Saws, rail
1 Spike puller
4 Tie tamping outfits
1 Tractor

Tennessee
1 Motor car, section
1 Rail and flange lubricator

Tennessee Central
2 Motor cars, inspection
2 Motor cars, section
2 Motor car frames
2 Wood borers
1 Wrench, impact

Terminal Railroad Association of St. Louis
4 Air compressors
1 Bucket, clamshell
1 Crane, locomotive, Diesel operated
4 Drills, portable
2 Generators, portable
3 Grinders, rail
6 Hammers, chipping
2 Hammers, riveting
1 Hammer, power
2 Jacks, pull
1 Magnet, lifting
2 Motor cars, inspection
1 Paint spraying outfit
2 Pumps, portable
1 Push car
4 Rail and flange lubricators
1 Shaper
4 Tie tamping outfits
5 Tractors
1 Velocipede
3 Welding outfits
1 Wrench, impact

Texas & Pacific
2 Adzing machines
2 Bolt tighteners
4 Boring motors
1 Crane, rail
1 Discer
1 Drill, rail
5 Generators, portable
5 Grinders, bench
3 Holders on
7 Motor cars, heavy duty
13 Motor cars, section
15 Motor cars, inspection
3 Mowing machines, rail mounted
6 Mowing machines, tractor mounted
2 Nail drivers
21 Rail and flange lubricators
1 Saw, timber
21 Saws, rail
4 Sanders
1 Screw driver, electric
4 Spike drivers
50 Tie tampers, unit type
40 Tie tamping outfits
1 Wrench, power

Texas Pacific-Missouri Pacific Terminal Railroad of New Orleans
1 Bolt tightener
1 Drill, rail, rail mounted
1 Grinder, rail, large
1 Mower, tractor mounted
1 Tie tamping outfit

Tucson Cornelia & Gila Bend
1 Motor car, section

Union Pacific
1 Automobile
4 Bolt tighteners
1 Bucket, orange peel
1 Concrete vibrator
2 Cranes, rail
1 Crane, locomotive
3 Cranes, locomotive Diesel powered
6 Derrick cars
2 Draglines
77 Drills, bonding
5 Drills, portable
95 Drills, rail
6 Extinguisher cars
1 Electric light plant
12 Grinders, rail, portable
1 Grouting machine
1 Hammer, steam pile
8 Jacks, power
6 Motor cars, heavy duty
48 Motor cars, inspection
8 Motor cars, section
1 Motorcycle service car
2 Motor trucks
2 Mowing machines, rail mounted
1 Paint spraying outfit
1 Pile driver
40 Push cars
4 Rail and flange lubricators
1 Sewer cleaning machine
1 Saw, rail
1 Spreader-ditcher
9 Tie tampers, unit type
4 Tie tamping outfits
1 Weed burner
1 Welding outfit

Union
1 Drill, rail
1 Motor car, section
1 Motor truck
2 Push cars
5 Rail and flange lubricators
1 Wrench, impact

Union Terminal Co.
1 Grinder, rail, portable
2 Rail and flange lubricators

Virginia Blue Ridge
1 Pump, portable

Virginia Central Railway
1 Shovel, power
1 Welding outfit

Virginian
1 Air compressor
2 Cranes, rail
1 Grinder, rail, rail mounted
10 Motor cars, section
5 Rail and flange lubricators
2 Tie tamping outfits
2 Rotary wire brushes
4 Wrenches, power

Wabash Railroad
2 Adzing machines
1 Air compressor
2 Drills, rail
1 Generator, portable
1 Grinder, rail, rail mounted
4 Mowing machines, tractor mounted
2 Saws, rail
1 Tie borer
8 Tie tampers, unit type
1 Tie tamping outfit

Washington, Idaho & Montana
1 Motor car, section

Western Maryland
2 Angledozers
4 Adzing machines
1 Air compressor
2 Ballast cleaners
2 Bolt tighteners
2 Concrete mixers

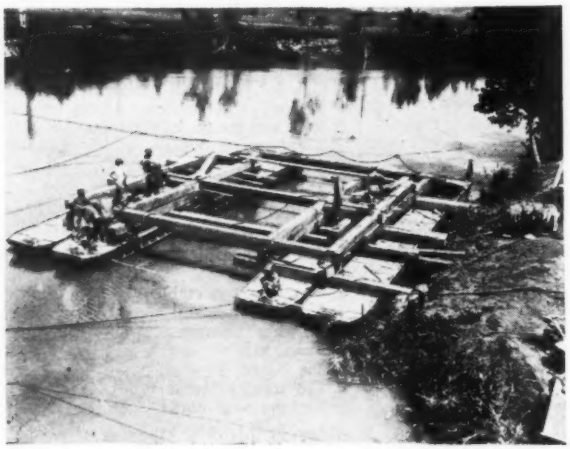
(Continued on page 66)

The situation that confronted the Railway Operating Battalions is shown in these two views. Fortunately the force of the explosion was so great that all the steel was thrown into the clear on the downstream side of the bridge site, where it did not interfere with the reconstruction work. Since the north shore (the far shore in both photographs) was entirely inaccessible for the handling of materials, all erection work had to be conducted from the south end. Aside from the damage to the bridge, a large bomb crater is visible in the approach fill at the bottom of the top view. Note, also, that both abutments were almost completely demolished so that, for all practical purposes, it was necessary to build an entirely new bridge.

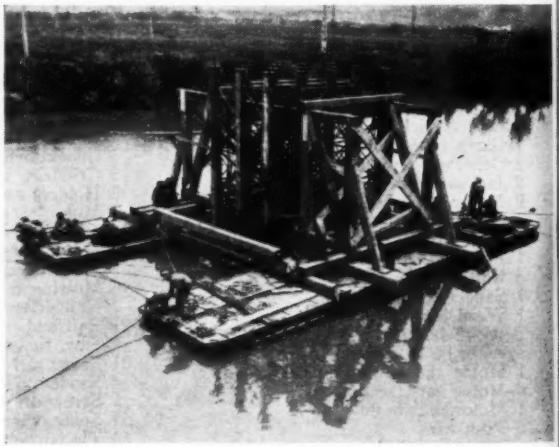
Railway

PRESENTED on these pages are views depicting the manner in which the "A" Companies of four American Railway Operating Battalions reconstructed a railroad bridge across the Garigliano river in Italy south of Minturno. The original structure was a 236-ft. double-track single-span through truss on masonry abutments. The distance from base of rail to bed of stream was 47 ft. and the depth of the water was about 22 ft. This span had been completely destroyed and blown into the river, and both abutments had likewise been demolished. Because of the need for bridging the river in the shortest possible time, a careful reconnaissance was made under shell-fire, and all plans for the project were worked out with as much detail as possible in rear areas. The procedure decided on was to restore the abutments in concrete and to erect on them a 240-ft. single-track through-truss span of Roth Wagner military bridging captured from the enemy.

Conditions at the site dictated that the entire span be erected from the south end. In view of the fact that barely enough of the captured material was available to complete the span, leaving none for counterbalance



The erection procedure adopted required that two temporary piers be installed in the river to support the bridge during erection. Since it was not practicable to employ ordinary piling for this purpose, a plan was worked out for using adjustable "camel's foot" bearings that are stocked by the railroad and docks troops of the British Army, special adapters being employed to permit these to be used with British military steel trestling.



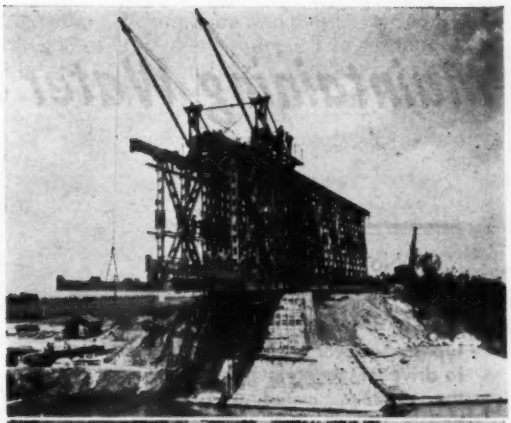
Barges were borrowed from the Engineer Corps and on these were erected timber frames, by means of which the lower sections of the trestling could be erected and suspended between the barges. The barges were then floated into place, the trestling lowered to the river bottom, adjusted to the proper plumb through the screw action permitted by a shaft extending through the trestling, and the balance of the trestling erected.

Battalions Do a Bridge Job in Italy

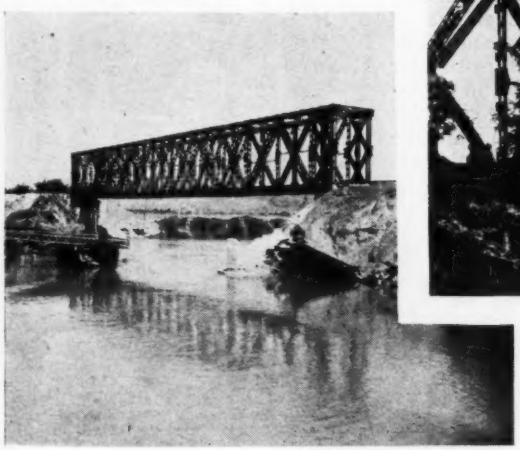
purposes, it was decided to erect the bridge by the cantilever method, first assembling 80 ft. of the span on shore for use as a counterbalance and then "cannibalizing" this portion later on to complete the span across the river. The procedure adopted required the supporting of the new span during erection at two intermediate points in the river, and for this purpose temporary piers of special design were erected.

The work divided into three general phases, all of which were carried out simultaneously. These were (1) the erection of the superstructure, (2) the reconstruction of the abutments, and (3) the fabrication and erection of the temporary piers. Permission was given by the tactical commander to commence construction of the bridge on the evening of May 15. Work was started the following morning and 14 days later, on May 29, the bridge was ready for trains.

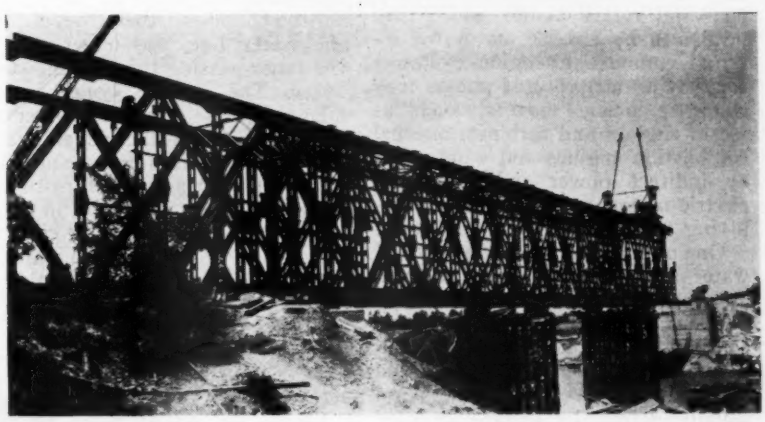
For further details on this and other bridge and reconstruction projects carried out in Italy by the Allied forces, see issues of the *Railway Age* for December 16 and 23, 1944.



The two views at the right show different phases of the erection work. Note in the top picture that an 80-ft. section of the bridge has been assembled on shore to serve as a counterbalance to permit cantilever erection of the span. So that erection could start without waiting for the concrete in the south abutment to set, special steel columns were fabricated from material salvaged from the wreckage of a local steel mill, and installed on the old abutment to carry the load of the bridge while the concrete was being placed.



This view shows the completed bridge after the temporary piers had been removed. Including the 80-ft. length that was assembled on the bank, the project included the erection of 320 ft. of bridging. The 240 ft. that was left in place was erected in nine days. Fourteen days after work on the project was undertaken the bridge had been completed and was ready to carry traffic.



In the view shown above, the work of erecting the bridge is approaching the north abutment, having passed the second temporary pier. Note that the 80-ft. cantilever span (at left end of bridge) is being "cannibalized" to obtain material to complete the structure. So well-timed and co-ordinated was the work that, at each temporary pier, the lower chord was just reaching out to a bearing as the bridge seat was being placed. Because of the speed of erection, it was necessary to land the steel span on the north abutment only four days after the placing of the concrete had been completed.

Maintaining Water Service Facilities—

POWER UNITS

Part I

By C. R. KNOWLES

Superintendent Water Service (Retired)
Illinois Central, Chicago

No. 9 of a Series

This article, of which this is Part I, deals with the various types of power units employed to drive water service pumps on the railways, including steam boilers, internal combustion engines, electric motors, air compressors and wind mills. Of special interest are the many helpful suggestions offered for the proper care of these units to secure their most satisfactory operation and most economical maintenance. Other articles in this series will discuss the transmission of power to and control of pumps, pipe lines, valves hydrants, tanks, water columns, etc.

THE TERM power pump is commonly accepted as applying to positive displacement pumps, operated by power applied through crank shafts and connecting rods. Actually, this term also covers centrifugal and rotary pumps which may be driven by electric motors or internal combustion engines. Power for driving all types of pumps may comprise prime movers, such as steam engines and turbines, internal combustion engines and wind mills, or indirect power units such as electric motors and compressors supplying air for deep well air lifts.

One of the most common types of water pumps comprises duplex steam and water cylinder units, with pistons connected to the same piston rod and thus avoiding the complication of a rotating crank shaft and connecting rods. Small pumps are usually driven by direct-connected power units, although gear drive and flat or multiple V-belt drive may be employed when necessary to get the required speed reduction.

Boilers

For many years the steam boiler predominated in numbers as a source of power for the operation of pumps used in railway water service, although it is being replaced by other forms of power at many water stations. Steam boilers are so well known and so widely used that a detailed description of their construction seems unnecessary.

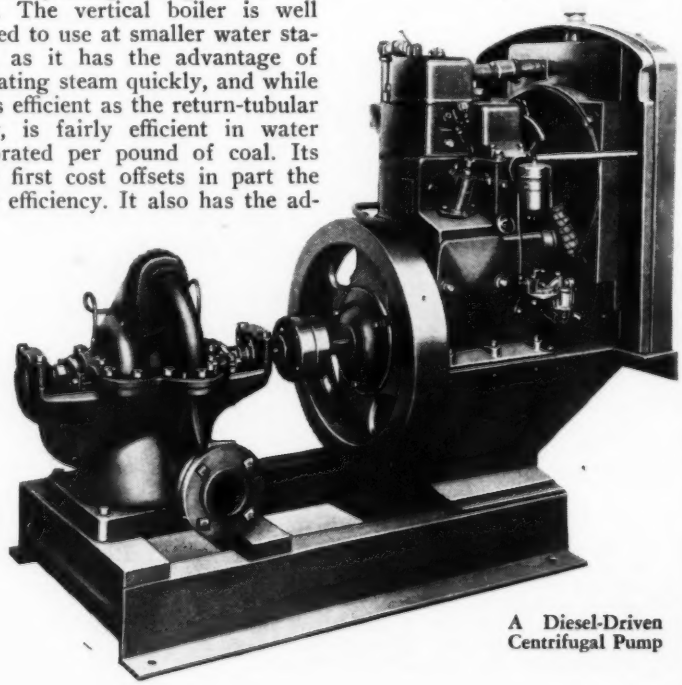
The boilers commonly used in water stations include both the vertical and horizontal tubular types, the former being employed in the greatest number.

Vertical Boilers

Vertical boilers are of two kinds. The submerged tube boiler, in which the upper flue sheet, together with the entire length of the tubes, are below the water line, and the full length tube type, in which the upper flue sheet serves as an upper head for the boiler and, therefore, is above the water line, the upper part of the tubes passing through the steam space. The vertical boiler is well adapted to use at smaller water stations, as it has the advantage of generating steam quickly, and while not as efficient as the return-tubular boiler, is fairly efficient in water evaporated per pound of coal. Its lower first cost offsets in part the lower efficiency. It also has the advantage of requiring a smaller area of floor space than any other type of boiler and can be readily installed or moved as required.

Horizontal Boilers

The locomotive or fire-box type of boiler is semi-portable and is usually mounted on heavy timber sills which permits it to be readily moved. When used on temporary work it is sometimes mounted on wheels for greater convenience in moving. The horizontal return-tubular boiler is more efficient than either the vertical or locomotive type, but is more expensive and represents a permanent installation, as it requires bricking in, the brick walls being lined with



A Diesel-Driven Centrifugal Pump

fire-brick to form the fire-box or furnace. The gases pass under the boiler for the entire length and return to the stack through the tubes.

Maintenance

Repairs to steam boilers and other pressure vessels used on the railroads comes under the jurisdiction of the mechanical department forces and no boiler work should be performed on these units by the water department forces, except in an emergency. Any work required on the boiler itself should be reported promptly to the mechanical department. The maintenance of boiler accessories, such as the gage cocks, water glasses, blow-off cocks, grates and boiler settings comes within the scope of the service repairman.

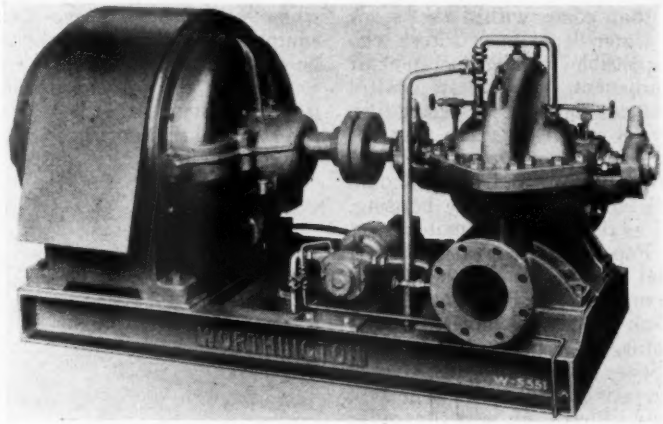
The gage cocks and water glass should be maintained in good order at all times and any leaks or stoppage handled promptly. The pumper should operate the gage cocks regularly instead of depending entirely upon the water glass as an indication of the water level in the boiler, as one is a check upon the other. The bottom of the water glass should be provided with a pet cock or valve, which should be opened occasionally to remove any sediment that may be present and prevent the water glass from functioning. This is of particular importance where water columns are used.

Blow-off cocks should be examined daily by the pumper and as often as possible by the water service repairman. Any indication of leakage should be attended to without delay. Blow-off piping should be carefully inspected for any deterioration to guard against a possible failure that might be followed by disastrous results. Extra heavy pipe should be used when renewing blow-off piping as standard pipe is not strong enough. When blowing down boilers, short blows at frequent intervals are more effective than extended blows at long intervals. The pumper should wash the boilers at regular periods and as often as necessary to keep them free from excessive accumulations of mud. If good water is used, or the water is treated and the boiler blown down regularly, washing it once each month should be often enough to keep it clean.

Tools should be provided for cleaning tubes and the pumper should clean the tubes each eight-hour shift. Expanding flue cleaners may be used on horizontal boilers, but blowers or flexible flue cleaners are required for vertical boilers.

Grates must be kept in good condition to permit good steaming and to prevent fuel waste. The accumulation of cinders under the grates and clinkers in the fire-box are responsible for much of the damage to grates. Grates should be properly designed for the fuel used. The openings in the grate should be smaller for fine coal than for lump or nut coal.

Good maintenance of the boiler setting is necessary to the efficient operation of the boiler where return-tubular boilers are used. The brick setting should be as near air tight as possible. Cracks should be repaired and sealing compound used on the outside of the setting if required. The fire brick lining of the fire-box should be maintained in good condition. The fire brick lining at the front of the fire-box should receive particular atention to prevent burning or warping fire doors and fire door lining. The accumulation of ashes in the combustion chamber back of the fire wall should be prevented to insure good steaming and prevent black smoke and fuel waste.



A Direct-Connected Motor-Operated Centrifugal Pump

Pumpers should keep boilers clean and the exterior of vertical and locomotive-type boilers should be painted with black oil or waste oil to prevent them from becoming rusty and unsightly. The gage cocks, water glass fixtures, piping and valves should be cleaned at regular intervals, the brass work polished and the piping painted. The stack, boiler hoods and breeching should be kept well painted to prevent deterioration from rust. This will add to their life and reduce maintenance. The flashing between stack and roof should be maintained in good condition and ample space should be provided between the stack and any woodwork or other combustible material to guard against the possibility of causing a fire.

Electric Motors

The squirrel cage induction type of motor, both horizontal and vertical, is commonly used in railway water pumping plants because of its simplicity and adaptability to the varying requirements of such service. Other types of motors are rarely used, except to comply with the power company's requirements, or where single-phase current only is available, or to meet other local conditions. The slip-ring or wound-rotor type of motor requires a lower starting current and is more acceptable to power companies, but it is more expensive than the squirrel-cage type. Special electrical characteristics, such as high starting torque with low starting current and normal starting torque with low

The Water Service Series

The eight articles in this series, published previously, include the following:

(1) Introduction (April 1944)
(2) Sources of Supply—Streams, Lakes, Springs and Reservoirs (May 1944)
(3) Sources of Supply—Wells (June 1944)
(4) Sources of Supply—Pollution of Wells. Intakes, Suction Lines, Pump Pits, Ice (July 1944)
(5) The Maintenance of Pumps—Reciprocating Pumps (August 1944)
(6) The Maintenance of Pumps—Centrifugal Pumps (September 1944)
(7) The Maintenance of Deep Well Pumps (Oct. 1944)
(8) Miscellaneous Pumps (December 1944)

starting current are available in all standard squirrel-cage motors.

Repairs to all motors and electrical equipment used in their operation are under the jurisdiction of the electrical department forces. However, there are certain details of operation closely allied to maintenance that come within the scope of the water department forces who are responsible for the operation of the equipment. The motor, control and pump should be inspected frequently, at which time any apparent defects should be reported. The bearings of the motor and pump should be well lubricated and the housing, as well as the pump and motor, kept clean. Paper, oily waste and other material should be disposed of in such a manner that it will not collect in switch or control boxes, or near the motor, electrical contacts or wiring. Spare fuses of the correct ampere rating should always be kept on hand. Pieces of wire or other substitutes for fuses, or fuses of a higher ampere rating than specified, should never be used. A fuse is an electrical safety valve, and is of the same importance to the motor as a safety valve is to a boiler.

The motor should be kept free from dust. Dust acts as a heat insulator on the windings of motors and may cause serious increase in temperatures. It also acts as an abrasive on the commutators, slip rings and bearings. Where motors are enclosed and fan cooled there is little danger of dust accumulating on windings and slip rings, but the motor should be kept clean for the sake of appearance if nothing else. To keep dust out of bearings, oil filler caps should be closed and dust seals and gaskets should be maintained in good condition and renewed when necessary.

Lubrication

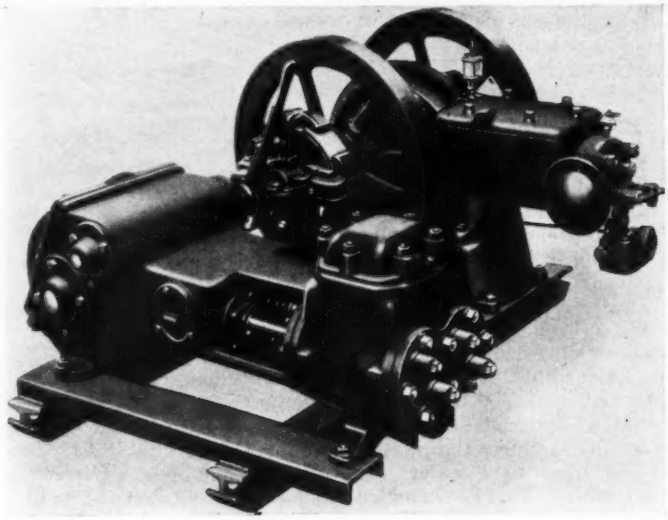
The lubrication of ball bearings is all too often neglected. Incorrect lubrication is the cause of most ball bearing trouble, although they can endure considerable punishment. The life of ball bearings is dependent very largely upon the method of lubrication. One of the largest pump and motor manufacturers has developed a method to be followed in the lubrication of ball bearings that has proved successful with both pumps and motors. The correct grade of grease is supplied in collapsible tubes, each tube containing the exact amount required for each particular bearing, depending on the size of the bearing. Instruction sheets accompanying the tubes recommend washing the old residue from the bearings before the new grease is used. It is also recommended that the bearings be relubricated approximately once each year, depending upon the service.

Excess oil is very harmful to the insulation of motors; it also collects dust. The bearings may throw oil when overfilled. Sleeve bearings equipped with oil rings should not be oiled while the motor is running to prevent the oil overflowing, as it is difficult to gage the correct oil level with the motor in operation.

Keep the motor dry; do not allow water to splash upon the motor unless it is of the splash-proof type. If a motor has become water-soaked, no attempt should be made to place it in operation until it has been thoroughly dried out, preferably by a skilled electrician. Motor trouble can often be anticipated and corrected by observing the operation of the motor. Excessive vibration can be readily detected by feeling the motor. The sense of touch is also often depended upon to detect overheating. This method is not reliable, however, as the temperature of the motor may be well within the limit and yet might feel excessively hot to an inexperienced operator.

Motors are designed for a 40-deg. rise in temperature, measured in centigrade. Therefore, if the initial temperature is high, perhaps 30 deg., the final temperature will be much higher than can be trusted to the sense of touch. About the only reliable method of determining the heat rise of a motor is through the use of a thermometer. The bulb of the thermometer should be applied directly to the windings and held in place by a bit of putty and it should be blanketed with waste to avoid incorrect readings that may be caused by radiation. Vibration is usually the result of the motor being out of balance. Overheating may be because of overloading, dirt or dust in the motor, rotor rubbing on stator, a short or a ground.

Fan-cooled, splash-proof enclosed motors are subject to a greater rise in temperature than open motors. As a result, they have less overload capacities. As a rule, under favorable conditions, the load on a 10-hp. totally-enclosed a-c motor can be increased 10 per cent as compared with an increase of perhaps 25 per cent on a 10-hp. open a-c motor.



A Gasoline-Driven Duplex Pump

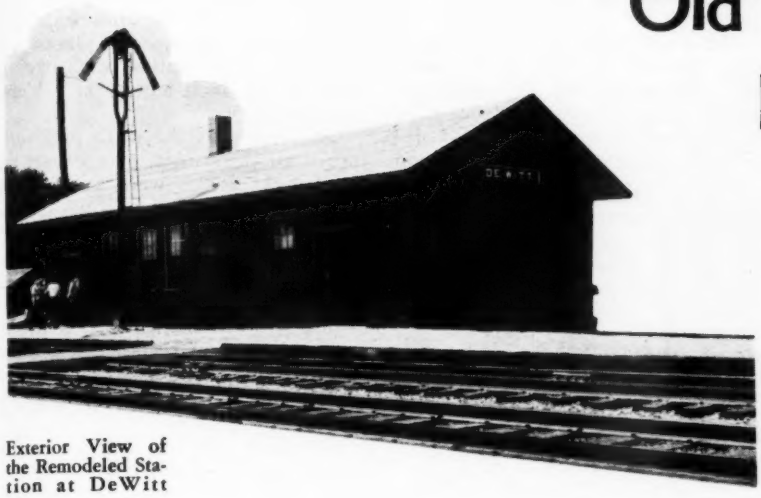
Overheated bearings may be caused by misalinement, excessive end thrust, sticking oil rings where sleeve-type bearings are used, or too much grease with ball or roller bearings. Where a belt or chain drive is used, such overheating may be from too much tension, because the belt or chain is too tight. Where trouble from overheating is electrical, the electrician should be notified.

Internal Combustion Engines

Internal combustion engines used in railway water service include gasoline engines, semi-Diesel engines and full-Diesel engines. They are used in combined pumping units, direct-connected units and with belt or chain drive units. Aside from the operations involved in developing the power, by getting the heat out of the fuel completely within the cylinder of the engine, an internal combustion engine is similar in operation to a steam engine, as the power is transmitted through pistons, connecting rods and cranks.

(Continued on page 66)

"Amputate" and Renovate Old Frame Passenger Station



Exterior View of the Remodeled Station at DeWitt

IN 1944, the Chicago & North Western made a number of changes in its old frame passenger station at DeWitt, Iowa, to provide a smaller and more attractive station in a better location. These changes were made after consulting with and accepting suggestions from the townspeople and, as a result, the town is well pleased with its "new" station. Briefly, the changes made consisted primarily of reducing the size of the station to fit the needs of the community better and to reduce heating and maintenance costs; moving the station to a location further from nearby stock pens, which is also more convenient to the main street of the town; changing the plan of the station interior to provide a more efficient and convenient arrangement of rooms; providing a new concrete foundation and new, longer platforms with adequate lighting; and complete redecoration and renovation to provide an attractive structure. Thus, with only a modest expenditure, the railroad succeeded in pleasing the townspeople and in remodeling the station so that the cost of heating, repairs and maintenance should be greatly reduced for many years to come.

Old Station

The station at DeWitt was built in 1858, and is located on the north side of a double-track main line, running east and west, which passes through the southerly edge of town. On this line, trains are operated left-hand running, and the preponderance of local passenger traffic is to and from the east. Thus, the station is located on the proper side to accommodate people waiting for eastbound trains to take them to Chicago or intermediate points.

The station is of frame construction and was in such a deteriorated condition that a general overhauling was necessary. In addition, it was larger than necessary, with a large freight room and two relatively large waiting rooms, one for men and the other for women. Its location was also bad, because it was close to the company's stockyards near the east end of the station grounds, and it was some distance from the nearest paved north and south highway (the main north and south street of the town), which crosses the tracks at the west end of the station grounds.

Recently, the Chicago & North Western decided to move its old frame station at DeWitt, Iowa, constructed in 1858, from its old location near a stockyard to a more convenient and desirable location. At the same time this work was done, the size of the building was reduced, a new concrete foundation was provided, and the remaining structure was completely rehabilitated and redecorated. The townspeople were consulted in the changes and provided several constructive suggestions

The old station was 99 ft. 8 in. long and 20 ft. 4 in. wide and included a freight room 44 ft. 2 in. long by 19 ft. wide at the west end; a women's waiting room 17 ft. 6 in. by 19 ft., east of and immediately adjacent to the freight room; a men's waiting room 20 ft. by 19 ft. at the east end of the building; and between the two waiting rooms, a ticket office, 16 ft. 6 in. by 14 ft. It also had an old shelter shed on the outside at the east end. The two waiting rooms were connected by a corridor behind the ticket office, and the ticket window, at the back of the ticket office, faced this corridor. The women's toilet was located in the northwest corner of the women's waiting room and the men's toilet in the northeast corner of the men's waiting room. In addition, a small room for trainmen, with a separate outside door, occupied the southwest corner of the ticket office area.

Several New Plans

Since current operating and traffic conditions at DeWitt did not require such a large station, it was planned originally to remove the shelter shed and the men's waiting room at the east end, and also 18 ft. from the freight room on the west end. It was also planned to relocate the men's toilet to a point alongside the women's toilet, to seal up the old ticket window, to install a new ticket window and a doorway in the west wall of the ticket office, and to provide new ticket counters in the office along the wall under the ticket window. In addition, it was planned to move the station about 200 ft. west, to put it further from the stock pens.

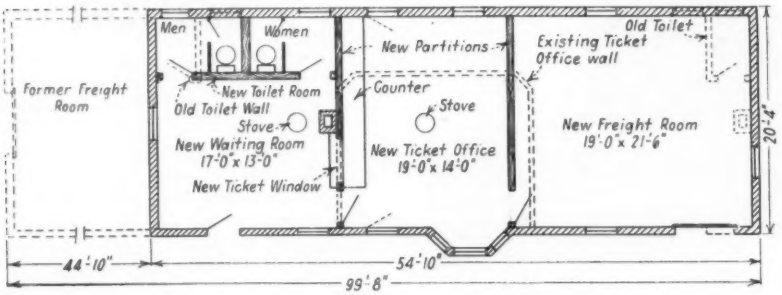
About the time the railroad was formulating these plans, the local newspaper and the DeWitt Community club began to campaign for

an improved station, with the result that the proposed changes were discussed with a committee of townspeople. This committee suggested that the station be moved more than 200 ft. west to get it closer to the paved highway. This would require an extension of the sewer and electric lines and a considerable amount of new platform.

After further consultation with the townspeople, a revised plan was drawn up and submitted, which called for removing 36½ ft. from the west end of the station, using the remainder of the freight room and former women's waiting room for the new freight room. This plan called for using the former men's waiting room for both men and women, and provided for toilets at the rear of this room. It also eliminated the corridor behind the office.

When this plan was proposed, the committee suggested that the waiting room should be at the west end of the station, nearest the paved highway, with the freight room at the east end. The committee also suggested that the platform be extended to the highway, removing some of the platform to the east. The former of these changes required turning the building as moved and constructing a new bay window for the telegraph operator.

It was finally decided to follow the recommendations of the committee, but to construct new office and toilet partitions instead of turning the building, using the former men's waiting room for the freight room by removing the toilet and chimney, and installing baggage room doors in its east and south exterior walls. This provided a smaller freight room than intended originally, but eliminated the larger cost of turning the station and constructing a new bay window.



Floor Plan of the Station, Showing in Dotted Lines the Areas and Partitions Removed

Final Plans

The final plan agreed upon was to reduce the over-all size of the station to 54 ft. 10 in. by 20 ft. 4 in., and to move it 220 ft. west. This new plan provided a waiting room 17 ft. by 13 ft., with two toilet rooms, each 5 ft. by 8½ ft.; a ticket office 19 ft. by 14 ft.; and a freight room 19 ft. by 21½ ft.

New Foundations

The work called for a new concrete foundation and a four-inch floor slab supported on compacted cinders, which were constructed of ready-mixed concrete, secured locally. It also required the relocation of three windows; the construction of new toilet and office partitions; the remodeling of the office counter, shelving, etc.; the installation of two sliding freight room doors; the relocation of the train order signal and telegraph wires; the extension of the water, sewer and electric lines; the construction of a new platform of limestone screenings and a cinder path to the paved highway; and realinement of the house track behind the station. An old Howe scale in the old freight room was retired and the new freight room was equipped with a portable freight room scale.

Most of this work was accomplished with materials recovered from the old structure and about the only additional materials or equipment used were 50 ft. of ¾-in. wrought iron water pipe, 50 ft. of cast iron soil pipe, 170 ft. of 6-in. vitrified sewer pipe, a small amount of wire, lumber, nails and cable, and one portable 20-in. by 20-in. freight room scale. Because the old station was urgently in need of repair, approval for the use of the critical materials needed was secured from W.P.B. on an AA-3 rating on March 20, 1944.

Renovation

At the same time this work was done, the station was completely repaired, redecorated and painted. The smaller station has a much more compact and trim appearance, and this appearance was further improved by covering the exterior with red rolled-aspalt siding in a brick patterns. Twenty-four squares of this material were used, together with 60 lin. ft. of outside corner strips. The roof deck was repaired and was covered with new slate-surfaced roll roofing. Completing the exterior, new station signs were placed on each end of the station, each having white 10 in. high letters on a black background.

On the inside, the walls and ceiling of all the rooms, except part of the freight room, were faced with beaded ceiling. The walls were painted a light blue up to the level of the window sills, with ivory above, which was carried across the ceilings. The waiting room is furnished with three benches, without intermediate arm rests, which were repaired and refinished. This room and the office are heated by separate stoves.

The office has one bench, a safe, a clerk's desk and chair, and an operator's desk and chair. Along the west wall, from the waiting room doorway to the back wall, shelves and a built-in counter are provided, the counter having a brown composition board top. The baggage room is finished, walls and ceilings, with unpainted beaded ceiling, and the concrete floor in that room has a rough finish.

This work described was planned and performed under the general direction of B. R. Kulp, chief engineer, and L. C. Winkelhaus, architect-engineer of the Chicago & North Western, and was done by the division bridge and building forces.

U. S. Marine Corps Photo

Navy Seabees make needed track repairs on a narrow-gauge railroad in Saipan

Failures to Protect Cause Motor Car-Train Collisions

FIVE trackmen were killed by two recent head-end collisions between track motor cars and trains, both of which would have been avoided if proper precautions had been taken, according to recent reports on these accidents by the Interstate Commerce Commission. The first accident, in which three men died, occurred during a dense fog about 7:30 a.m. September 30, 1944, near Glenwood Junction, N. Y., on the Lehigh and New England, while the second, which resulted in two fatalities and two injuries, took place in a cut on a curve near Parkdale, Ala., on the Central of Georgia, about 7:10 a.m. on October 27, 1944. Abstracts of reports of these accidents follow.

Violation of Train Order Rule

The Lehigh and New England accident occurred on a single-track line extending westward from Pine Island Junction, N. Y., to Swartswood Junction, N. J., 25.1 miles. There were no time-table schedules in effect on this line and no block signals, trains being operated by train order only.

Extra 305 West, consisting of Engine 305, 28 cars and a caboose departed from Pine Island Junction about 7:25 a.m., and, while moving at an estimated speed of 20 m.p.h., collided with track motor car No. 567 at a point 1.71 miles west of Pine Island Junction. The motor car departed eastward from Sussex Junction, 9 miles west of Glenwood Junction, about 7 a.m., and, while moving at an unknown speed, collided with Extra 305 West about 7:30 a.m., killing the foreman and two other members of the track force.

At 6:35 a.m., the track foreman communicated by telephone with the train dispatcher to inform him that his motor car was to proceed from Sussex Junction to Pine Island Junction and was advised that Extra 305 West had departed from a station 20 miles east of Pine Island Junction at 6:30 a.m. The foreman made no request for a train order to authorize the movement of the motor car, and the dispatcher issued no order. The motor car, occupied by the foreman and two laborers, departed from Sussex Junction about 7 a.m. and had traveled eastward 9.5 miles when it collided with Extra 305 West. Because of dense fog at the point of accident, the members of the crew on the engine did not see the motor car before it was struck.

The rules of the railroad required that section foremen must be familiar with the current time-table and rules and regulations of the operating department. Furthermore, special instructions issued October 2, 1937, required train orders authorizing motor car movements wherever possible.

In the investigation it developed that it had been a long-standing practice for motor cars to be operated on the main track without train-order authority. The superintendent, the chief train dispatcher and the train dispatcher said they understood that train-order authority for motor car movements was not necessary unless specifically requested.

The commission concluded that, if the movement had been made by train-order, the track motor car would not have been permitted to leave Sussex Junction prior to the arrival of Extra 305 West and the accident averted.

Line-up Ignored

The motor car accident on the Central of Georgia was caused by failure to clear the time of or to protect against an over-due first class train. It occurred on a three-degree curve on the Birmingham district of the Columbus division at a point 1.34 miles east of Parkdale, Ala.

No. 53, a westward first class passenger train, departed from Columbus, Ga., at 5:23 a.m., 8 minutes late, passed Goodwater, Ala., 4.5 miles east of Parkdale, at 7:07 a.m., 9 minutes late, and, while moving at an estimated speed of 50 m.p.h., collided with a track motor car.

The motor car, towing a trailer, departed eastward from Parkdale about 7 a.m. and, after traveling east 1.34 mi., while moving at an estimated speed of 15 m.p.h., was demolished when struck by No. 53. The weather was clear at the time of the accident, which occurred about 7:10 a.m. The foreman and one other member of the track force were killed and two others were injured.

The rules governing the operation of track motor cars on this line provided that flag protection must be furnished to protect their movements wherever and whenever necessary. Motor car operators were authorized to obtain information regarding the movement of trains, but they were not permitted to use this information as authority to operate their cars without protection.

At 6:50 a.m., about 20 minutes prior to the accident, the foreman secured a line-up of trains by telephone from the train dispatcher. Because it was less than ten minutes late, the dispatcher informed the foreman that No. 53 was on time. In spite of the fact that No. 53 was due at Parkdale at 7:04 a.m. and was reported on time, the motor car and trailer, occupied by the foreman and three trackmen, departed from Parkdale about 7 a.m. and had moved east about 1.3 mi. when it collided with No. 53. Because of embankments on the inside of the curve, the occupants of the motor car were unable to see the approaching train, and the enginemen of No. 53 were unable to see the motor car until just before the collision. After the accident, the line-up, as issued by the dispatcher, copied in the handwriting of the foreman, was found in the foreman's pocket. None of the surviving members of the crew had been informed by the foreman of the information he had obtained regarding train movements.

The Commission found that this accident was caused by the operation of a track motor car without protection against an opposing train.

Constant Vigilance is Essential to Safe Operation of Motor Cars On Todays High-Speed Railroads

$14,400,000 for Work Equipment

(Continued from page 57)

3 Drills, rail
7 Grinders, rail, portable
1 Jack, power track
3 Motor cars, inspection
2 Motor cars, section
1 Motor truck, dump
8 Rail and flange lubricators
2 Tractors
1 Welding outfit

Western Pacific
4 Air compressors, portable
1 Bucket, clamshell
1 Drill, rail
2 Generators, portable
6 Rail and flange lubricators
28 Tie tampers, unit type
2 Wrenches, power

Wheeling & Lake Erie
4 Air compressors
1 Bulldozer
1 Crane, rail
1 Hammer, pile
1 Jack, power
6 Motor cars, heavy duty
4 Motor trucks
2 Mowing machines, tractor mounted
1 Planer

Yadkin
1 Motor car, section
2 Rail and flange lubricators

CANADA

Canadian Pacific
1 Angledozer
6 Bolt tighteners
1 Bucket, clamshell
1 Bucket, dragline
4 Bulldozers
25 Cars, hand
3 Concrete mixers
2 Cranes, rail
3 Discers
4 Drills, rail
4 Generators, portable
5 Grinders, rail, portable
2 Grinders, rail, rail mounted
1 Jack, power
47 Motor cars, inspection
14 Motor cars, section
2 Motor cars, heavy duty
106 Motor car frames
4 Mowing machines
116 Push cars
1 Push car, derrick
3 Pumps, portable
45 Rail and flange lubricators
3 Saws, timber
3 Saws, rail
1 Shovel, power, combination crane-dragline
1 Spreader ditcher
4 Tie tampers, unit type
8 Tractors
2 Welding outfits
1 Winch for mounting on tractor

Midland of Manitoba
1 Motor car, section

Newfoundland
6 Motor car engines

Northern Alberta
1 Crane, wrecking
1 Dragline

Quebec Central
4 Motor car frames

Sydney & Louisburg
2 Motor cars, section

Temiskaming & Northern Ontario
1 Bucket, clamshell
1 Concrete mixer
1 Paint spraying outfit
5 Rail and flange lubricators
4 Tie tampers, unit type
1 Track jack, electric

Toronto, Hamilton & Buffalo
4 Tie tampers, unit type
4 Weed burners

MEXICO

Southern Pacific Railroad Co. of Mexico
1 Grinder, rail, portable
10 Motor cars
6 Motor car frames
1 Tie borer

Power Units for Water Service

(Continued from page 62)

Most of the internal combustion engines used in railway water service are single-cylinder engines, operating at comparatively low speeds, but the modern trend is toward the use of the higher speed multiple-cylinder type. Many of the earlier engines up to 25 hp. capacity were started by hand, either by a crank or by rocking the fly wheel. While some of these older engines are still in service, practically all engines of more than 5 hp. capacity installed in recent years are provided with starters. The methods used are compressed air, auxiliary gasoline engines or storage batteries with electric starter.

Gasoline Engines

Gasoline engines, as the name implies, are designed primarily to use gasoline as a fuel, although some have been converted to oil-burning engines by the addition of attachments to permit the burning of kerosene and low grade oils. In some few instances they have also been converted to the use of gas as a fuel. Gasoline engines of the single-cylinder, four-cycle type were used extensively in railway water service for many years, and a large number are still in service. More recent installations have been multiple-cylinder engines of the four-cycle type. New installations have been confined largely to standby units and for temporary service. They are used extensively for operating portable pumps. The majority of the earlier engines were horizontal engines and many were provided with make-and-break ignition. Their operation was not always reliable and their maintenance was high, and with few exceptions they have been replaced with more modern engines.

Oil engines commonly used for pumping at railway water stations are chiefly of the semi-Diesel type, which is a modified form of the full-Diesel. In these engines the oil is injected as a liquid, and they are governed by measuring the oil supplied to the cylinder. In most of these engines ignition is accomplished by means of a hot tube or surface heated by a blow-torch before starting, the heat then being maintained by the successive explosions. Another type of oil engine employs spark-plug ignition in which a gasoline primer is used. In this type, a small charge of gasoline is sprayed into the air intake manifold when starting. After the engine is started, it operates on fuel oil, which is also ignited by the electrical spark.

Full Diesel Engines

The full Diesel engine is essentially a high compression engine in which the temperature of the air at the compression end of the stroke is high enough to ignite the fuel and produce continuous combustion. As in the gasoline engine, the heat or combustion cycle can be completed once every revolution in the two-cycle engine, or once every two revolutions in the four-cycle engine.

Two methods of injecting oil into the combustion chamber are employed, air-injection and solid-injection. The air-injection system employs a multi-stage air compressor which delivers the injection air at pressures ranging from 800 to 1,500 lb. per sq. in. The solid injection method does not require an air compressor, the oil being injected by a plunger-type fuel pump which forces definite quantities of oil through the atomizing nozzles at high pressures, frequently in excess of 10,000 lb. Both methods atomize the oil, either by means of small spiral grooves in the injection nozzle or through very fine holes about 0.016 in. or less in diameter.

Diesel engines are used to some extent in railway water stations. The more extensive use of the Diesel in this service has been retarded because they were not available in suitable sizes, and because of their higher cost. With the continued development of smaller engines and a possible reduction in cost, they will undoubtedly be used more extensively for pumping as they are more economical in the use of fuel than any other form of power. The further development of automatic control for Diesel engines, already used with some success in railway pumping, places them in competition with electricity, because of the great difference in the cost of operation.

What's the ANSWER?

How to Distribute Ties

In view of the present density of traffic and speed of trains, what is the most practical method for distributing ties? What other considerations govern?

Prefers Work Train

By W. H. SPARKS
General Inspector of Track, Chesapeake & Ohio, Russell, Ky.

From my point of view ties should be unloaded from work trains, even though traffic may be slowed down locally for a short time. There is always a certain hazard in handling ties, as there is with other heavy materials, so why repeat it? A tie needs to be unloaded from a car only once, and this time should be the last time it should be handled until it is being inserted in the track.

Where ties are unloaded at station grounds, this becomes the first of a series instead of the last handling. They must be loaded onto push cars or trailers and the foreman must wait until he gets a clear track, which may be for only a restricted time. Then he must rush out and unload them on "short time". This requires three separate handlings for each of the several hundred ties contained in each car in the shipment, which not only runs into more money, but also it more than triples the hazard.

Conditions Differ Widely

By C. D. TURLEY
Engineer of Ties and Treatment, Illinois Central, Chicago

Conditions surrounding the distribution of ties differ widely on individual roads and even more widely in different sections of the country. Careful study and co-operation by all departments concerned in the shipment and distribution of the ties are necessary to determine what are the best methods for the particular territory involved and how the best results can be obtained in moving the ties from the treating plants or storage yards and in distributing them to the point of use.

The costs of the distribution, both direct and indirect, are considerable and require careful study. Extra handling of the ties, extra haul of the loaded cars, back haul of the empty cars, use of cars badly needed in revenue service and the unloading of ties at points where installations are unlikely, should be avoided so far as it is possible to do so.

To obtain the best results, it is necessary to treat ties when they have finished seasoning. For this reason, many ties are treated well in advance of the time when they will be inserted in the track. It is also desirable to season ties for at least six months after treatment before they are inserted, but because of lack of storage space at treating plants and the extra cost of rehandling ties, most roads, over a period of years, have developed the practice of shipping ties as they are treated, to points where they are to be installed, or to station grounds or storage yards along the right of way, where they are stacked and held for subsequent distribution.

Send your answers to any of the questions to the What's the Answer Editor. He will welcome also any questions you wish to have discussed.

To Be Answered in March

1. *What practical arrangements can be made to insure that consignees will receive advance notice of the arrival of company material, to avoid delays in the release of the cars?*

2. *What are the advantages of a small carpenter shop at division headquarters? What work can be done effectively in such a shop? What tools and equipment should be provided? Are there disadvantages?*

3. *In view of the present decreased effectiveness of track labor, what is the maximum number of men a foreman should be expected to supervise? An assistant foreman? Does the kind of work make any difference? Why?*

4. *Can waterproofing be applied with equal success to new and old concrete surfaces? If not, why? Do the methods of application differ? Why?*

5. *What is the best time of year for treating soft spots in the roadbed? Why? Does this differ for different methods of treatment?*

6. *Does the type of pump in service affect the maintenance of pipe lines? Its condition? If so, how?*

7. *Should the spike holes in double-shouldered tie plates be flush with the shoulders, or should they be slightly inside? Slightly outside? Why? How much?*

8. *To what extent is the use of treated lumber economical or practicable for buildings? What members? What form of treatment is most desirable?*

Considerable economy can be obtained by storing treated ties at the treating plant and distributing them as they are required by the various divisions or districts. This scheme avoids the reloading by hand and reshipment of stored ties when they are needed urgently at some distant point as a result of changes in plans. It is

also believed that ties stored after treatment at the treating plants will provide a more flexible supply than is possible when they are stored along the railway.

Probably the plan that is followed most extensively and accepted most widely, of transporting ties from treating plants or storage yards to points of use, is by local freight trains. The cars containing the ties are spotted on tracks at station grounds, the ties are unloaded and later are trucked to the points of insertion. However, distribution by train loads, where conditions permit, is obviously the most economical plan. By special stacking after treatment, the ties can be handled with a locomotive crane, thus simplifying and facilitating both the loading and the unloading. On districts where the renewals are comparatively heavy, the ties can be unloaded close to where they are to be inserted, so that trucking and rehandling are eliminated. Present density of traffic and the ever-increasing speed of trains demand careful supervision of all operations and close co-operation between all departments in the shipment and distribution of ties.

Unload at Stations

By C. E. Miller
Assistant Engineer of Maintenance, Chicago & North Western, Chicago

Since the railways must handle the present volume of traffic with the equipment now available, it is of the utmost importance that work-train service be held to the minimum, and that cars containing company material be unloaded promptly. The shipment of ties involves the use of a considerable number of cars so that it becomes of great importance that they be unloaded immediately upon receipt, to save every car day possible.

With the foregoing situation in mind, I believe that carloads of ties should be shipped to the station most convenient to the point where the ties will be used and that the section forces should unload them immediately upon arrival and release the cars. A liberal portion of the tie allotment should be received early in the year, and the section gangs should distribute them by motor car and trailer, taking out loads frequently as they go over the section on track inspection or to perform other duties. In this way sufficient ties will be distributed at the point of use to enable them to proceed with tie renewals as early as weather conditions permit. Obviously, they should follow the same practice throughout the period that ties are being shipped. The station at which they should be unloaded may not always be the one closest to the point of use, but may be selected because the ties can be hauled down grade or where favorable unloading space is available.

Heating Pump Houses

To what extent is it necessary to heat pump houses where the pumps are under automatic operation? If heating is necessary, how can it be done?

Electric Heating Best

By E. M. Grime
Engineer of Water Service, Northern Pacific, St. Paul, Minn.

One of the chief reasons for automatic operation is to avoid the employment of full or part-time attendance. Wherever electricity is available, it is usually a simple matter to make use of equipment, the operation of which can be controlled by the elevation of the water in the storage tank or the pressure in the distribution system, but keeping the temperature in the pump house above the point where freezing of small pipe lines, gages, etc., may occur, is not so easy unless electricity can be held at a reasonable rate.

There are few places across the northern half of the country where temperatures do not drop below freezing for some part of the winter. Where men are always available for other purposes throughout the year, it may be most economical to provide a small stove to be fired when heating becomes necessary. All pump houses in cold climates that are insulated thoroughly and provided with storm windows and doors, pay large dividends in heat savings. If they are maintained in good shape, it is safe to assume that the temperature inside the building will be about 10 deg. warmer than it is outside.

Where water is to be used for sanitary purposes, the board of health will require that the discharge line be above ground, so that heating protection becomes essential. There are some railway installations, however, where all of the pumping equipment can be readily placed below the ground level where frost will not affect it. If, for some reason a gage line is necessary, extending up to or near the ground line, this may be protected by using some non-freezing liquid, such as oil, in the exposed part of the line; or it may be protected by an insulated box covering or by providing a tight tin or wood-box enclosure where an ordinary electric-light bulb at the bottom of the tube will keep the gage line warm.

Electricity is the ideal heating medium and, even though the rate may seem high, if the thermostatic control is adjusted carefully, so that the power will come on and remain on only to prevent the temperature from dropping below about 40 deg., it will often provide protection at much lower cost than stove heat, especially when the uncertainty of human control is considered. There are also small oil heating devices that can be regulated by thermostatic control when electricity is not available.

May Not Need Heat

By Supervisor of Water Service

The necessity for heat and the method of heating pump houses where pumps are under automatic control, will depend on a number of factors, including (1) the type of pump; (2) the location of the pump; (3) the type of housing; and (4), to a certain extent, on whether the water is pumped from wells or from surface supplies. If installed correctly, deep-well pumps of the automatic type will require no heat; in fact, many of them do not require a pump house. In such it is necessary to use weatherproof motors and arrange for heating the lubricating oil, and the discharge piping must be below the frost line or be protected from freezing in other ways. Where it is possible to place pumps in pits, little, if any, heat is required, provided the pit is well covered.

Pump houses may be heated by various means. If they are near a power house, the simplest method is to use steam; in other cases it may be advisable to install a small heating plant. Most automatic pumping plants are operated electrically, thus requiring little heat, being heated electrically in most cases. The pump house should be as small as possible to conserve the power current, and the house should be insulated. In all cases the heat should be controlled thermostatically, and regulated so that the temperature will not fall below 40 deg. or rise above 45 deg., since electric heating is expensive under the most favorable conditions. In some cases, the power

company will provide special rates for the heating current.

Ordinary strip heaters are used frequently, generally because of low first cost, but in most cases it will be more economical to use the grid type, as they require less current and because of their construction give off more heat. With this type and the control set so that the temperature will be maintained slightly above freezing but maintained within a narrow range, the cost of heating the pump house will be kept to the minimum.

What Limit for Power Tools?

What is the smallest building repair job on which it is feasible or economical to use power tools? Bridge repairs? What are the advantages? The disadvantages?

Hardly Any Job Too Small

By V. E. Engman
Chief Carpenter, Chicago, Milwaukee, St. Paul & Pacific, Savanna, Ill.

Where electric power is available, there is scarcely any building repair job too small for using the electrically-operated circular hand saw, or wood borers or drills where boring or drilling is required. These tools are light and can be moved easily to and from the job. If electric power is not available, the size of the job will determine whether it will be economical to bring out the gasoline-operated bench saw. It is our practice to order all lumber to the required dimensions and to have all special framing done at the mill, so that most of the sawing in the field is that of cross-cutting. The gasoline-driven hammer is used for almost all small jobs that require the breaking of concrete or similar work.

In the past, the power units for operating power tools on bridge work were quite heavy and required considerable effort to get them to and from the job. For this reason, they were used on only the larger repair jobs. Lately, a gasoline-operated generator weighing around 200 lb. has been developed, that will furnish enough power to operate a chain saw. This unit can be carried on a motor-car trailer with other tools and used on any job that requires sawing or boring. When present restrictions allow this unit to become available, it is going to make a valuable addition to our bridge-repair equipment.

Have Learned a Lesson

By L. G. Byrd
Supervisor Bridges and Buildings, Missouri Pacific, Poplar Bluff, Mo.

Owing to the present shortage of labor and to the large number of small buildings that stand in need of repair, we have learned a valuable lesson with respect to the use of small portable power tools assigned to two or three men, and we have found them equally valuable in repairing larger buildings as well. In fact, we could not keep up with demands for work if it were not for the help we are able to obtain from these easily-portable tools.

We have electric current or compressed air, or both, available at practically all of our buildings, and at the few points where neither form of power is available, we are using small gasoline-driven generators or compressors, often transporting them by motor truck to and from the site of the work.

The primary advantages in the use of power tools are that (1) they increase the output of the small gangs we are able to work on minor repairs and thus (2) shorten the time of completion, and (3) do this without increasing the effort that the men must exert. Furthermore, it has been demonstrated many times that the work performed with these tools is neater and more uniform than work performed by hand; while, of prime importance, the number of personal injuries is reduced measurably.

Recently, we painted the exterior and interior wood surfaces of a large building with a portable paint-spraying outfit, the work being performed by two men, whereas, with former methods we would have required six to eight men, and for a longer period. This is an example of the fact that the matter of economy is also involved.

We are now sending out two or three men to make repairs to small buildings, equipping them with power tools. Without the power tools these jobs formerly required the assignment of six to eight men. These repairs include such buildings as telephone booths, scale houses, coal bins and toilets at outlying points, and involve the renewing of steps, siding, doors, windows and sheathing. These small groups also make light repairs to bridges, such as renewing walkways, bannister posts and railing, applying guard timbers, tightening bolts with power wrenches, and other items.

In my experience, I have found no disadvantage in the use of small power tools for the purposes enumerated.

Fighting Snow with Weed Burners

To what extent and in what ways can weed burners be used in fighting snow? Where? What are the advantages? The disadvantages?

Are of Real Help

By District Engineer

Weed burners are being used rather extensively in fighting snow. One railway of which I know has been using weed burners for this purpose for more than ten years. They have proved to be so successful in this application that they are considered indispensable and, in the large terminal in which they are used principally, are looked upon as a part of the normal snow-fighting equipment. On this road, all weed burners are moved into important terminals before winter, where they are held in readiness for immediate use when the first snow of any storm falls. Five of these units are assigned to one large terminal.

As they are moved to their winter assignments the operators who handled them during the summer months accompany them and are given employment where they will be readily available in the event of a snow storm. These burners are used for melting snow at switches in passenger yards, around interlockings and, most important of all, at hump yards to keep the car retarders free of snow. It has been stated officially that in this service one weed burner will do as much as 80 men with brooms during a heavy snow fall, and will do it better. One railway officer made the statement recently that the weed burners they have been using for fighting snow have more than paid for themselves in this service alone, in the actual saving they have made, compared with normal costs, and that it is impossible to compute their value in the present crisis with respect to labor.

Considerable concern has been ex-

pressed as to the formation of water and as to the difficulty of draining it away. Success in the operation of a weed burner for fighting snow requires that it be placed in service as quickly as possible after the snow starts to fall. The heat from the burners is of sufficient intensity to vaporize the water and thus dissipate it. On the other hand, if the snow is allowed to accumulate, the heat will not be sufficient to vaporize all of the water that forms as the snow melts and trouble may be experienced from both water and ice. According to weather bureau figures, it requires from 8 to 16 in. of snow, with an average of 10 in., to make 1 in. of water when melted. The desirability of starting the melting as soon as the storm begins is, therefore, apparent.

The number of switches that can be kept clear with one weed burner will depend on the rate of snowfall, whether the snow itself is light or heavy, the location of the switches and the amount of traffic over them. In a 6-in. snowfall it was found that four minutes were required to clear a switch, but if the burners were started when the snow began to fall, this time was reduced to two minutes.

The advantages include the requirements for less men, less interference with traffic, particularly over car retarders, and less hazard to the men working about the track. There are no disadvantages if the burners are operated correctly.

They Are Effective

By Supervisor of Track

While we have not made large use of weed burners for melting snow, we have experimented with them sufficiently to prove that they can be effective, and to learn one or two things about their operation that may make the difference between success and failure. We have learned also that they can be of real help in the complete absence of the temporary help we have been able to draw on in past years. A weed burner in a yard can be of surprising value as an aid to the regular forces. We used them experimentally last winter and expect to use them more extensively this winter if the need arises.

We learned, first, that it is important to have an experienced crew to operate the equipment; otherwise too much valuable time is lost in handling the car and directing the flame. Another thing that is of urgent importance is to get the burners on the job as soon as the storm starts. It is much easier to keep up with or ahead of the snow if this is done, than to catch up with it if it is allowed to accumulate to a depth of several inches before the burners are brought into action. If the weed burner is put in action at once the ties will remain dry, but if it is started late, some trouble may be experienced with water from the melting snow. In the first instance, a switch can be cleaned in one slow movement over it; in the latter, it will require two or three times as long, a fatal loss of time in a storm.

What Are Wane, Warp and Skip?

Is wane a natural or a manufacturing defect? Warp? Skip? How do they affect the use of lumber?

May Be One or Both

By Chester J. Hogue

In Charge Technical Service, West Coast Lumberman's Association, Seattle, Wash.

Wane is the lack of wood, from any cause, on the corner of a board or piece of timber. It is a part of the original surface of a log. In sawing a log, a slab is cut off each of the four sides. The next strip or cant cut, will have wane on one or both edges, or a timber may have wane on one or more corners. Wane occurs from not sawing a piece of lumber or a timber from far enough inside a log to have all corners come within the original surface.

In a board, a piece of finish and in dimension sizes, its effect is mainly on appearance, for which reason it is permitted only in the lower grades. In timbers, wane seldom reduces strength as much as other strength-reducing factors that are permitted. Its percentage reduction of strength is approximately three times its percentage reduction of area. If appearance, full width of bearing or other factors require, square edges should be specified. Wane is a natural characteristic, which would be a manufacturing defect if occurring in a grade that does not permit it to be present.

Warp is any variation from a true or plane surface. It includes bow, crook, cup or any combination of these defects. Bow is deviation flatwise from a straight line from end to end of a piece. Crook is deviation edgewise from a straight line from end to end of a piece. Cup is curve in a piece across the grain or width of a piece. Warp and its components occur in seasoning, caused by cross grain or lack of uniformity in quality or texture, and is accentuated by unequal distribution of moisture in a piece when seasoning. Its effect is mainly on appearance or on the fit of a piece in place. It is a natural defect which, if the causes are present, may not be wholly avoidable in seasoning. The resulting material must be sorted into grades in which it is permitted.

Skip is an area on a piece that failed to surface. It is caused by surfacing or planing a piece too lightly, or by attempting to surface a piece that is too thin to a finish thickness desired. Its effect is on appearance. It is a manufacturing defect.

Are Common Imperfections

By R. R. Cahal

Assistant Manager, Southern Pine Inspection Bureau, New Orleans, La.

The industry's definition of wane is that it "is bark or the lack of wood from any cause on the surface of lumber." It is usually thought of as a natural growth imperfection, due to the fact that the most commonly encountered type of wane involves bark or the lack of wood at a point once occupied by bark. In the process of manufacturing rough lumber, the production of pieces that are oversize in one or both dimensions is inevitable, and the grading rules for rough lumber make allowance for this variable factor. It is possible to vary the manufacturing process of sawing, edging and trimming to increase or decrease the amount of wane left on a piece of lumber. It may at times be desirable completely to eliminate wane from particular pieces, and especially where the quality of such pieces may be high in other respects. On the other hand, if the quality is to be limited by imperfections other than wane, there would be no point in sacrificing footage unnecessarily to reduce or eliminate wane.

For particular uses, wane can be objectionable from a standpoint of appearance. It is probably on this account that the wane restrictions are so severe in the grades of lumber intended for finishing purposes. In the Wood Handbook, a U.S. Department of Agriculture publication, prepared by the Forest Products Laboratory, a statement is made that "Wane within the limits likely to be permitted by other considerations has a comparatively small effect on strength."

The industry's definition of warp is that it "is any variation from a true

or plane surface. It includes bow, crook, cup, or any combination thereof." It is usually regarded as a natural imperfection, and such an appraisal may often be correct. It would be true as regards warp that develops in a piece because of lack of uniformity in texture throughout the piece. Regardless of the texture, lack of uniformity in moisture content or seasoning throughout a piece may cause warp to develop.

There is no natural warp in lumber that is wholly green. Since there is no way of determining with any degree of certainty the extent to which warp may develop in the seasoning of lumber, measures cannot always be taken through the sawing and edging process in green lumber to offset or minimize this development in individual pieces. However, when dry lumber is dressed or is further sawed and edged, these manufacturing processes can be performed in a manner to reduce or eliminate warp that may have developed.

When the natural shape of a piece of lumber is distorted to any noticeable extent by some external force, or even by its own weight, the warp that can develop therefrom may remain in the piece long after the force is removed. This characteristic makes it very desirable for care to be observed in adhering to good practices in stacking lumber, regardless of whether the stacking involves dry lumber for storage or green lumber for seasoning.

Warp does not appreciably affect the strength of lumber, and in some cases it does not even affect its usability. For example, crook may not be objectionable in small sizes where nailing may serve to hold the pieces in proper position. Likewise, bow in sheathing and light framing lumber is not generally objectionable because the nailing is usually quite adequate for minimizing this deficiency. When sheathing lumber is used for some special purpose other than ordinarily contemplated, bow can constitute a serious imperfection. While bow is not generally objectionable in light framing, such as studs, joists, etc., crook is quite objectionable in joists. It is likely to be very objectionable in heavy framing lumber or in any other lumber graded for special use.

The industry's definition of skip is that it "is an area on a piece that failed to surface." A skip is usually looked upon as being a manufacturing imperfection, and this appraisal is quite generally correct. It is an imperfection that is limited to dressed lumber, although it is mostly caused by some deficiency in the manufacture of the rough product which has not been fully corrected by the process of dressing. Since an area of roughness is quite noticeable in a piece of dressed lumber, this imperfection is largely objectionable from a standpoint of appearance. This accounts for the exacting limitations on skip dressing as they ordinarily apply to standard grades of finishing lumber.

Specifications for dressing to special, nonstandard sizes quite often authorize "hit-or-miss" and "hit-and-miss" dressing. In the definitions of both of these provisions, the amount of scantness due to skip dressing is limited to 1/16 in. Where the conditions of use are such as to make it desirable, specifications may be written to require a quality of lumber entirely free of skips. However, it is a somewhat rare occurrence for this to be done.

Related to Manufacture

By General Inspector of Buildings

Wane and warp are both related to manufacture, although neither one is necessarily the result of defective processes. Wane may be defined as bark or as the absence of wood on the edge or corner of a piece of lumber or a timber. Warp is any variation from a plane surface, including cup, bow or crook. Cup is a curve or dish across the grain; bow is deviation flatwise and crook is any deviation edgewise from a straight line stretched from end to end of the piece. Skip is an area that was missed by the planer when the piece was being surfaced. In this connection, hit and miss is a series of skipped areas with surfaced areas between.

All of these defects affect the appearance of the lumber in place in the structure, provided they are exposed to view. If extensive, wane may have a serious effect on the strength of the timber and even, under certain conditions, of boards. It is not a natural defect, and should not be classed as a manufacturing defect, unless specifications exclude it. Warp is partly a natural and partly a manufacturing defect; that is, it may result from lack of uniformity in the structure of the wood or from unequal distribution of the moisture during the seasoning period. On the other hand, it may result from carelessness or lack of attention while seasoning. Skip is wholly a manufacturing defect. It affects appearance only.

Assignment of Work Equipment

What types of work equipment should be assigned permanently to a supervisor's district? To a division? What types should be considered regional or system equipment? Why?

Use a Vital Question

By J. G. Hartley
Assistant Engineer, Pennsylvania, Philadelphia, Pa.

In the use of mechanical units in maintenance of way work, the vital question is how to obtain as near a continuous full-day use of each unit as possible, to obtain the greatest return on the investment. The assignment of mechanical units is predicated on the method pursued by the maintenance-of-way department of the railway in performing the numerous items of work requiring the use of such equipment.

Where allotments are small, the laying of new rail probably is performed by a supervisor assembling his section and extra-gang forces. This results in loss of production on the various sections that furnish men and the use of mechanical equipment, if available, would necessitate continuous transfer from point to point, as required, resulting in serious loss of time in the use of the equipment. On the other hand, the regional chief engineer is thoroughly acquainted with the rail program and can provide an adequate force on a rail-laying train, which can distribute and lay the rail more economically than it can be done separately by any supervisor of track. The minimum number of mechanical units is required in such an operation and is, therefore, more efficient and economical than any other method.

In the tabulation that follows, some of the units are shown as system or regional only, such as machines for laying rail. These units should be handled by special gangs, organized on a system or regional basis, but assigned to specific tasks and temporarily to particular districts as the work progresses. These assignments are indicated by "x". Where two assignments are shown, whether region and division or division and district, the permanent assignment is to the superior territory and the officer in charge makes temporary assignment to the subordinate territory, and when the work is done transfers it to another part of the region or division.

Where assignment is indicated to the region, division and district, the system or region allocates the machines to the divisions according to a prepared schedule and the division, in turn, makes the allocation to the district as the program requires. The same arrangement is carried out where the assignment is shown as both division and district, and the units are moved from point to point as work is completed.

In general, mass production is more economical than piecemeal production, and the nearest approach to mass production can be made by assigning the units according to the principles outlined, in which case the officers having jurisdiction must exercise strict control over the assignments and over the use that is made of them, transferring promptly those units that are not working to points where they can or will be used to obtain the production desired.

Assignment of Work Equipment

Unit	Supervisor's District	Division	System or Region
1. Adzers	.....	.....	x
2. Ballasters, power	.....	.....	x
3. Ballast cleaners, large	.....	.....	x
4. Bolt tighteners	.....	x	.....
5. Bonding machines	x	.....	x
6. Boring machines, earth	.....	.....	x
7. Boring machines, tie	.....	x	x
8. Boring machines, track	x	.....	x
9. Buckets, clamshell	x	x	.....
10. Compressors, air	x	x	x
11. Concrete breakers	.....	x	.....
12. Concrete mixers	.....	x	.....
13. Cranes, locomotive	.....	x	.....
14. Cranes, crawler	.....	x	.....
15. Cranes, rail	.....	x	x
16. Discers and scarifiers	.....	.....	x
17. Ditchers, steam	.....	x	.....
18. Extinguisher cars	.....	.....	x
19. Generators, portable	.....	x	.....
20. Grinders, adzer bit	.....	.....	x
21. Grinders, reciprocating	x	x	.....
22. Grinders, surface	x	x	.....
23. Grinders, cross	x	x	x
24. Grinders, stock rail	x	x	.....
25. Grinder cars	.....	.....	x
26. Jacks, power	.....	.....	x
27. Magnets, lifting	.....	x	x
28. Milling machines	x	.....	.....
29. Moles, ballast cleaner	.....	x	x
30. Motor trucks	x	.....	.....
31. Mower, rail mounted	.....	.....	x
32. Mower, power, hand guided	.....	x	.....
33. Mower, tractor mounted	.....	x	x
34. Paint Sprayers	.....	x	.....
35. Pile drivers	.....	x	.....
36. Pumps, portable	.....	x	.....
37. Saws, rail	.....	x	x
38. Saws, timber	.....	x	.....
39. Spike drivers	.....	.....	x
40. Spike pullers	.....	.....	x
41. Spreader-ditchers	.....	x	.....
42. Sucker-cleaning track	.....	.....	x
43. Sweeper, cleaning track	.....	.....	x
44. Tie tampers	x	x	.....
45. Tractors and bulldozers	.....	x	.....
46. Trailers, highway	x	x	.....
47. Weed burners	.....	.....	x

How Much Will It Be Used?

By Malcolm E. Condon
General Yard Foreman, Erie, Croxton, N. J.

Primarily, the basis for assigning any unit of work equipment to a specific section or district of a railway is the extent to which it can or will be used in the prosecution of programmed and normal maintenance work. In so far as the supervisor's district is concerned, it is generally recognized that a 1½-ton motor truck with a stake body can be utilized effectively in moving men, materials and equipment over the district. Bolt tighteners and rail drills, both power driven, are of high utility, particularly when the district includes one or more yards, where rail renewals and switch work are important phases of maintenance. There are additional advantages if a machine operator is employed for these two machines, or for any power unit that may be assigned temporarily to the division from time to time during the working season.

Units assigned to the division should include those that cannot be used continuously on a district, but that can be used to the fullest extent by establishing a work schedule over the division. Each of these machines should be in charge of a capable operator who stays with the machine as it is moved from district to district. Regional equipment includes units that are assigned to specific projects of construction or maintenance, and to definite work programs that include more than a single division. No mention is made of the many smaller units, including power tools, for in most cases they are assigned to specific gangs.

While conditions vary between railways and, often, between certain sections on individual roads, a typical assignment would be about as follows:

To a supervisor's district: Motor truck with stake body, bolt tightener, power rail drill.

To a division: Trucks with dump bodies; air compressors, rail mounted; tie-tamping outfits and spot tampers; spike-pulling and spike-driving equipment; cribbing machines and ballast cleaners; adzing machines; rail saws and rail grinders; weed burners and mowing equipment, including hand-guided power mowers; portable generators; locomotive and rail cranes; and bulldozers.

Regional or system equipment should include spreaders and ditching equipment; pile drivers; power shovels, drag lines and other large earth-moving units, such as carry-alls, rooters, and sheep's-foot, and road rollers.

Bridge Work During Winter

In view of the existing labor shortage and the present volume of traffic, is it practical to carry on routine bridge work during the winter? What work? What precautions should be taken? Why?

Now Behind Schedule

By Engineer of Bridges

Because of the labor shortage, the delay in procuring needed materials, as well as of the dense traffic now being carried, it is probable that most of the authorized bridge programs will show a lower-than-normal percentage of completion on December 31. Traffic density has been a real factor in lengthening the time required to complete most projects during the past year, as compared with the work of normal years.

It is not only feasible but desirable to do routine bridge work and even major construction during the winter months. The maintenance of bridges, such as renewing caps, stringers and ties; the installation of open decks on steel bridges; the tightening of bolts and, in fact, any work in which frozen soil or ballast is not involved, may proceed through the winter. It is not feasible, however, to erect steel of all types. The replacement of wood or temporary shims under steel with permanent shims, grillages, reinforced concrete blocks, and similar work can be undertaken readily.

Repairs to masonry, such as painting, replacement of bridge seats and rebuilding of backwalls, where new concrete will be in contact with existing masonry, should not be undertaken except in cases of urgent necessity, because of the difficulty of raising the temperature of the old masonry to the point where the new mortar or concrete will not be frozen. It is feasible, however, to construct piers, abutments, boxes and other structures of concrete, provided the usual precautions of heating the aggregates are undertaken and the concrete is kept warm until it has hardened.

Footwalks, timber and materials must be kept sufficiently free from snow and ice to provide ample safeguards to eliminate hazards to workmen. In preparation for the work, the location of material piles should be studied carefully to prevent the formation of snow drifts across operated tracks. Again, the plant layout for the job should be such as to insure efficient operation of the forces engaged in the work, even though unusually severe weather may be encountered.

If a bridge is on falsework and conditions are unfavorable for combatting spring floods, it is obviously desirable to complete the work and remove the falsework to insure clear openings for the passage of ice and drift during high water.

To reach the goal of completion of an annual bridge program by May 15 of the year following its authorization, it is generally necessary to work during the winter on at least some of the projects. The foregoing points are matters of common knowledge to maintenance officers and those who have to do with construction and operation. I am sure that most of them are in accord with the principle that much bridge work is not only feasible during the winter, but is a real necessity if authorized programs are to be completed early enough to insure that they will not interfere with starting the program for the following year.

Have Always Done It

By General Inspector of Bridges

While the present labor shortage is hampering somewhat severely our routine bridge maintenance program, and the unusual density of traffic now being carried is placing an added obstacle in the way of orderly and economical prosecution of work, none of these factors should be accepted as an excuse for abandoning winter work on bridges, but rather as an added reason for continuing our routine work through the winter, with the purpose of getting as much of it done as we can. This is a practice that we have always followed in normal times, and I can see no reason for discontinuing it at this time when there is so much to be done and so few men with which to do it. Obviously, the unusual density of traffic will hamper, sometimes seriously, some of the work we have on our program, but that, again, is not a valid excuse for failing to do the thing that needs to be done.

In the main, the precautions that are necessary for winter work are well understood. Special attention should be given to flagging, even though the track may not be obstructed, whether men are working on the deck or below it. Men are generally rather heavily bundled up during cold weather so that they are less quick in action than when they are clothed more lightly. Added to this is the fact that many of them are in the older age brackets, giving still more reason to do everything practicable to reduce personal injuries.

Drainage During the Winter

Does the probability of sudden thaws during the winter or early spring warrant the opening of ditches where snow has been plowed from the tracks? Why?

Must Open Waterways

By Supervisor of Track

My experience indicates that the danger of flooding from sudden thaws does warrant the opening of ditches where snow has been crowded back in the cut by operation of snow plows. In this connection, it may be equally important to open the mouths of culverts, particularly those at highway crossings. The necessity for these precautions is multiplied if the snow goes off with a warm rain.

Where water has no outlet, it will flow over the track, then in case the temperature falls suddenly and drastically, the resulting ice may become a real hazard. In such cases, deep and wide ditches in the snow may pay for themselves in a single day.

Recommends Ditching

By George M. O'Rourke
Assistant Engineer Maintenance of Way, Illinois Central, Chicago

The heaviest snow-removal work on the Illinois Central is handled by Russell snow plows or with spreader-ditchers, although considerable use is made of wedge plows. When the storm has subsided, clean-up is essential if succeeding snow-removal operations are not to be impeded by accumulations of previous snowfall. The disposal of the snow and provision for drainage after a storm is a matter of urgent necessity.

Sudden thaws during the winter and early spring may cause disastrous floods if the water cannot get away gradually. Side ditches in the snow can be made with the spreader-ditcher. The spreader wings can be used to advantage to widen the cuts after they have been opened, and to move snow out of the cuts so that larger ditches may be provided. Culverts and channels of streams must be cleared of obstructions.

Often, these thaws are followed by a sudden drop in temperature, resulting in accumulations of ice. The prompt removal of snow and ice from the vicinity of tracks, switches and interlockings serves a two-fold purpose in the present maintenance of traffic and the provision for later snowfalls.

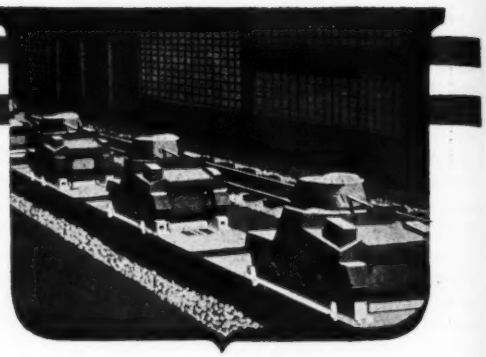
Get Rid of Water Quickly

By W. H. Sparks
General Inspector of Track, Chesapeake & Ohio, Russell, Ky.

Wherever water is likely to stand in cuts, measures should be taken to get rid of it as quickly as possible by means of adequate drainage. Water from melting snow should be led away by the quickest and shortest route. There is always the danger that if free flow is obstructed, the water will rise until it overflows the track. Then if a sudden cold snap occurs, the ice that forms on the track may become a real menace. If the temperature remains above freezing, the danger of sliding cuts may become a matter of equal concern.

Again, if the water soaks into the roadbed and softens it, soft track may give as much trouble as the ice, especially in view of the number of trains we are operating today, because of the difficulty of maintaining line and surface. Taken all in all, the best thing to do is to get rid of the water in the most practical and the quickest way.

NEWS of the Month



Decorate Army Railroaders

Ten army railroaders, members of the Transportation Corps, Military Railway Service, have been cited by the Italian government for their services in the "rehabilitation, reconstruction and operation of the Italian State Railways." Among those decorated were Brig. Gen. Carl R. Gray, Jr., Director General, Military Railway Service (formerly executive vice-president Chicago, St. Paul, Minneapolis and Omaha, at St. Paul, Minn.) and Col. Benjamin H. Crosland, assistant general manager-engineering, or chief engineer, of the Military Railway Service in the Mediterranean Theater, who was formerly division engineer on the St. Louis-San Francisco at Fort Scott, Kan.

Public Likes Railroads Unaware of Competitor's Subsidies

Ninety-four per cent of the American people are of the opinion that the railroads have done a good job during the war according to the fourth annual survey of public opinion regarding transportation recently completed by the Opinion Research Corporation of Princeton, N.J., for the Association of American Railroads. Asked their belief as to the relative importance of the various means of transportation, 88 per cent said the railroads were the major agency, 10 per cent said trucks, and two per cent said river carriers. Fifty-eight out of 100 people thought there was equality of competitive conditions in transport, while of the 42 persons who considered competitive conditions unequal, 27 believed that other agencies of transportation were inequitably handicapped.

Asked what form of transport received the most public aid, 54 per cent of those queried thought the railroads had benefited most, 24 per cent the airlines, 14 per cent the highway carriers, and 8 per cent river carriers. When the question was reversed to ask what forms of transport received the least benefit from the public treasury 47 per cent expressed no opinion. Of the remainder, 44 per cent thought highway carriers received the least assistance, 27 per cent river carriers, 17 per cent railroads, and 12 per cent airlines.

The report concludes that the railroads face four major problems arising from inadequate and inaccurate public information of government aids to transportation: (1) a high percentage of the people have no knowledge at all of governmental favors to transportation; (2) the predominant opinion seems to be that the railroads have benefited from such favors more than their rivals; (3) past favors of this kind are not criticized; (4) present and future favors are not objected to, if the recipients are to be some form of transportation other than the railroads.

5 Billions Expenditures Forecast for Post-War Projects

The railroads of the United States can well afford to spend 5 to 10 billion dollars for self-liquidating projects after the war if they are given even half-way assurance of a fair chance to compete for post-war traffic, according to an article in the December issue of "Fortune." The article tells in detail of projects totaling 95 million dollars which the Rock Island could easily spend if it should decide to make "super-railroads" of its main lines, and then applies those proposed expenditures to the nation's railroads as a whole. Among other items, the article recommends main-line grades not in excess of 0.5 per cent, except in mountainous regions, to enable the handling of 5,000-ton minimum trains. Main lines, according to the article, should be designed for over-all passenger train average speeds of 70 m.p.h.

Pacific Coast Traffic Sets New Record in November

Civilian and military freight traffic to the Pacific Coast set a new record in November when an average of 4,795 carloads a day, consisting of 3,369 to California and 1,426 to the Pacific Northwest, were handled over Western railroads, according to William F. Kirk, western director of the Railway Transport department of the Office of Defense Transportation. This compares with 3,266 cars daily to California and 1,314 daily to the Pacific Northwest, or a combined average of 4,580 a day in October 1944; 2,855 to California and 1,223 to the Pacific Northwest, or a combined average of 4,078 a day in November 1943; and 2,456 to California and 996 to the Pacific Northwest, or a total average of 3,452 cars a day in March, 1943, when the first figures were compiled.

This volume, Mr. Kirk said, has been handled despite a shortage of 25,000 workers on Western railroads. "The railroads," he continued, "are hauling all the freight given them, with less delay than a year ago. In addition to the heavy military burden, they are carrying the loads normally handled by costal shipping and oil tankers, a record grain crop and immense ore shipments."

Personnel Needs Remain at 90,000

Reports of needs for additional personnel submitted by the railroads, as of November 1, to the Railroad Retirement Board, indicate little change from the preceding month, shortages of 90,000 workers being reported by 188 roads. This compares with a 90,000 shortage reported by 187 roads in the previous month and a shortage of 99,000 estimated for the entire industry. Personnel needs increased somewhat in the Southwest, in the area around the Great Lakes, and the Northeast, but decreased by an equal amount in the other areas.

The reports indicated a total shortage of 1,077 bridge and building carpenters, of which 240 were in the Pacific Coast region and 377 in the Northwest region. Needs for 293 bridge and building carpenter helpers and 425 bridge and building laborers were also reported. Total shortages of 24,464 sectionmen and 9,464 extra-gang trackmen were shown divided as follows: 2,834 sectionmen and 1,537 extra trackmen wanted in the Pacific Coast region; 4,290 sectionmen and 2,497 extra-gang men needed in the Northwest; 4,890 sectionmen and 3,048 extra-gang men required in the Southwest; 2,791 sectionmen and 713 extra-gang men short in the Southeast; 5,467 sectionmen and 1,320 extra-gang men needed in the Great Lakes region; and 4,192 sectionmen and 349 extra-gang men wanted in the Northeast.

Commenting on the requirements for track laborers, the board states, "Personnel needs for laborers, as reported for November 1, were 2.6 per cent less than a month earlier. Most of the decrease was in needs for track laborers.

"On the Pacific Coast, the decrease of 6.2 per cent was almost all due to a decline in track laborer shortages, which may reflect the arrival of many additional Mexican nationals in this area."

Changes in Railway Personnel

General

W. J. Driscoll, supervisor of track on the Alton at Slater, Mo., has been promoted to assistant trainmaster, with the same headquarters.

H. Gordon O'Leary, superintendent of the Lakehead division of the Canadian National, and an engineer by training and experience, has retired.

Thomas L. Doyle, assistant to the general manager of the Western region of the Pennsylvania, with headquarters at Chicago, and formerly connected with the engineering and maintenance of way department of that road, has retired after more than 44 years service. Mr. Doyle was born at Tremont, Pa., on September 25, 1878, and was graduated from the University of Pennsylvania in 1903. On July 1, of the same year, he entered railway service as an assistant in the engineering corps of the Pennsylvania on the Cincinnati division. He was promoted to division engineer on the Mackinaw division in 1920, and served as assistant to chief engineer from 1921 to 1923, during the construction of the Pennsylvania's Detroit extension. In 1923, Mr. Doyle was again appointed a division engineer, serving on the Grand Rapids and Columbus divisions until January 16, 1939, when he was further advanced to assistant to the general manager at Chicago.

Engineering

Homer Allen Dise, assistant engineer of structures of the Erie at Cleveland, Ohio, has been promoted to engineer of structures with the same headquarters, succeeding **Allen M. Knowles,** who has

A. M. Knowles

retired at his own request. **Alfred A. Visintainer,** assistant engineer in the department of structures, has been promoted to assistant engineer of structures succeeding Mr. Dise. Mr. Knowles was born at Corinna, Me., on June 22, 1879, and was graduated from the University of Maine in 1904. He entered railroad service in June, 1905, as a structural draftsman on the Erie, at New York, and in November, 1906, was promoted to assistant engineer, structural department. In 1915 Mr. Knowles was advanced to assistant engineer, bridges and buildings, and five years later became assistant engineer of structures, holding that position until February 1, 1943, when he was promoted to engineer of structures.

Mr. Dise graduated in civil engineering from the University of Pennsylvania in 1906 and became a draftsman with the American Bridge Company at Elmira, N. Y., in June of the same year. In January, 1910, he entered railway service as a structural designer for the New York Central in connection with the electrification of the Hudson and Harlem divisions. Mr. Dise went with the Erie in September, 1918, as a structural de-

H. A. Dise

signer, and on March 1, 1920, he was promoted to chief draftsman, with headquarters at New York, later being transferred to Cleveland. On February 1, 1943, he was advanced to assistant engineer of structures.

G. W. H. Perley, division engineer on the Canadian National at Campbellton, N. B., has retired.

M. M. Churchill, division engineer on the Canadian National, with headquarters at Prince Albert, Sask., has been transferred to Kamloops, B. C.

B. Chappell, assistant engineer on the Canadian National at Saskatoon, Sask., has been promoted to division engineer of the Portage-Brandon division, with headquarters at Winnipeg, Man., replacing **N. M. Waddell,** who has been advanced to district engineer with the same headquarters, succeeding **R. W. Ross,** who has been promoted to engineer maintenance of way at Winnipeg, in place of **F. B. Tapley,** who has retired. Mr. Tapley was born at St. John, N. B., on October 17, 1876, and entered railway service in April, 1890, as a messenger and clerk of the Intercolonial Railway of Canada (now a part of the Canadian National) at St. John. From 1903 to 1916 he served as rodman, instrumentman, resident engineer and assistant engineer, maintenance of way on the Canadian Pacific, with headquarters at St. John, Brownsville Junction, Me., London, Ont., and Montreal, Que. In July, 1916, Mr. Tapley went with the Canadian National as an assistant engineer, and between that date and May, 1923, he was promoted to assistant engineer maintenance of way and engineer maintenance of way, with headquarters at Moncton, N. B. In May, 1923, he was transferred to Edmonton, Alta., and ten years later to Winnipeg, Man., remaining in the latter location until his retirement.

Waring L. Codington, division engineer on the Canadian Pacific at Medicine Hat, Alta., has been promoted to district engineer with headquarters at Winnipeg, Man. Mr. Codington was born at Auburn, Neb., on November 19, 1889, and received his higher education at the University of Nebraska. He entered railway service with the Canadian Pacific in June, 1910, as a stakeman at Winnipeg, and served in various capacities on location and on construction until November, 1914, when he was assigned to the operating department as a trackman. In 1915 Mr. Codington was appointed resident engineer, with headquarters at Revelstoke, B. C., and a short time later he was transferred to Vancouver, B. C. From May, 1919, to June, 1921, he served as assistant engineer on harbor work, with the same headquarters, and from the latter date to May, 1923, he served in a similar capacity on the Connaught tunnel, with headquarters at Glacier, B. C. A short time later Mr. Codington was advanced to division engineer of the Winnipeg Terminal division, and on February 1, 1925, he was transferred to the Medicine Hat division, with headquarters at Medicine Hat, Alta., remaining in that location until his new appointment.

Bert L. Beier, assistant engineer on the Delaware, Lackawanna & Western at Buffalo, N. Y., has been promoted to division engineer at Scranton, Pa., succeeding **Louis L. Tallyn,** who retired from active service on January 1. Mr. Tallyn was born at Benson, Ill., and graduated from the University of Illinois. He began railway work on June 1, 1901, as an instrumentman on the Chicago, Burlington & Quincy, and the following year he became a transitman on the Illinois Central. From 1903 to 1904 he served as division engineer on the Chicago, Cincinnati & Louisville (now part of the Chesapeake & Ohio), and then entered the service of the Lackawanna as an assistant engineer. In 1910, Mr. Tallyn was promoted to superintendent of water service, and in 1911 he was appointed division engineer, with headquarters at Scranton. During the first World War, Mr. Tallyn served for a time as acting chief engineer, returning at the close of the United States Railroad Administration to the position of division engineer at Scranton, which he held until his retirement.

Francisco Malagamba, whose promotion to engineer maintenance of way of the National Railways of Mexico, with head-

quarters at Mexico City, D. F., was reported in the November issue, was born at Puebla, Pue., Mexico, on April 5, 1899, and was graduated from the National University of Mexico City in 1923. He entered railway service on February 22, 1927, as assistant division engineer on the Torreon division of the National Railways of Mexico, with headquarters at Torreon, Coah., later serving in a similar capacity at Monterrey, N. L. In November, 1928, he was advanced to resident engineer at Torreon, and in May, 1929, he was promoted to division engineer, with the same headquarters, subsequently serving in this capacity at Monterrey, Puebla and other points. On January 16, 1937, Mr. Malagamba was appointed engineer of water service, with headquarters at Mexico City, and four years later he was advanced to assistant engineer, maintenance of way, with the same headquarters, holding that position until his new appointment.

Roy Norman Brodie, chief draftsman, engineering department, of the Boston & Maine at Boston, Mass., has been appointed assistant structural engineer, with the same headquarters. Mr. Brodie was born at Egremont, England, on October 5, 1897, and first entered railway service in 1915 as a draftsman on the Canadian Pacific. In 1919, after three years' military service in the Canadian Army, he was employed by a private firm as a draftsman, following which he re-entered railway service as a bridge draftsman for the Missouri-Kansas-Texas Lines in St. Louis, remaining in that position until 1925, when he became a designing engineer for a private firm on road construction in Florida. In 1927 he was employed by the Michigan highway department as a bridge designer, leaving that position in 1928 to become a structural draftsman for the Boston & Maine at Boston. In 1929, Mr. Brodie was advanced to chief draftsman, holding that position until his recent promotion.

E. E. Young, whose retirement as division engineer on the Chicago, Burlington & Quincy at Burlington, Ia., was reported in the December issue, was born on October 13, 1879, at Panora, Ia., and received his higher education at Highland Park College. Mr. Young entered railway service in 1903 in the engineering department of the Chicago, Rock Island & Pacific at Des Moines, Ia. In 1905 he resigned to accept a position as instrumentman on the Chicago, Burlington & Quincy, advancing to office engineer in 1907. He was appointed assistant engineer in 1921 and was promoted to division engineer in 1934, the position he held at the time of his recent retirement.

C. R. Bergman, division engineer of the Renovo division of the Pennsylvania, with headquarters at Erie, Pa., has been transferred to Chicago, succeeding **J. F. Swenson,** who has been granted a leave of absence on account of ill health. **T. M. Goodfellow,** supervisor of track at Harrisburg, Pa., on the Philadelphia division, has been advanced to assistant division engineer of the Philadelphia Terminal division, with headquarters at Philadelphia, Pa., replacing **J. W. Wallenius,** who has been promoted to division engineer of the Renovo division in place of Mr. Bergman.

Track

John W. Shaw, supervisor of track on the Baltimore & Ohio at Punxsutawney, Pa., retired on September 30, after 52 years of service with the B. & O.

Edward Eugene Nichols, a section foreman on the Chesapeake & Ohio, has been promoted to assistant supervisor of track, with headquarters at Newport News, Va.

L. L. Wallis, roadmaster on the Missouri Pacific at El Dorado, Ark., has been transferred to Gurdon, Ark., a change of headquarters.

Harry E. Way has been appointed assistant supervisor of track on the Pittsburgh & Lake Erie, with headquarters at McKeesport, Pa.

J. W. Smith, Jr., assistant engineer, research, on the Erie at Cleveland, Ohio, has been promoted to general foreman, maintenance of way, with headquarters at Youngstown, Ohio, succeeding **R. T. Davis,** who has retired.

John W. Cates, section foreman on the Missouri & Arkansas, has been promoted to roadmaster, with headquarters at Leslie, Ark.

Arthur P. Vogel, whose promotion to roadmaster at Madison, S. D., on the Chicago, Milwaukee, St. Paul & Pacific, was reported in the December issue, was born at Hokah, Minn., on November 19, 1904, and received his education in the Hokah public schools. Mr. Vogel entered railway service as a sectionman at Hokah on September 1, 1918, and on April 1, 1934, was promoted to extra gang foreman on the Iowa and Southern Minnesota division. He served as section foreman from March 15, 1939 until 1943, when he was again appointed extra gang foreman on the Iowa and Southern Minnesota division. In 1943 he was transferred to the Twin City terminal division, the position he was holding at the time of his recent promotion.

Harold E. Carter, whose promotion to roadmaster on the Norfolk & Western, with headquarters at Petersburg, Va., was reported in the December issue, was born at Bedford, Va., on June 25, 1917, and entered railway service on June 25, 1939, as an inspector in the maintenance of way department of the N. & W. at Roanoke, Va. In February, 1941, Mr. Carter was advanced to assistant roadmaster at Pulaski, Va., and three months later he was transferred to Grundy, Va. He was transferred to Roanoke in November, 1941, and on January 1, 1942, he was appointed assistant supervisor of bridges and buildings at Portsmouth, Ohio. Mr. Carter was appointed assistant roadmaster at Bluefield, W. Va., on July 10, 1944, which position he held until his recent promotion.

M. H. Murphy, who has been on leave of absence from his position of supervisor of track on the Alton at Slater, Mo., has returned to active service succeeding **W. J. Driscoll,** whose promotion to assistant trainmaster is reported elsewhere in these columns.

H. Silvernail, assistant supervisor of track on the Alton at Bloomington, Ill., has been promoted to supervisor, with headquarters at Joliet, Ill., succeeding **John L. McMillan,** who has been transferred to Springfield, Ill., in place of **W. E. Frazier,** who has retired.

W. E. Grant, relieving roadmaster on the New Brunswick district of the Canadian Pacific, has been appointed acting roadmaster at Kentville, N. S., on the Eastern division of the Dominion Atlantic, a part of the Canadian Pacific system, succeeding **W. O. Kelly,** who has been granted a leave of absence.

Frank W. H. Minifie, whose recent promotion to roadmaster on the Canadian Pacific at Cranbrook, B. C., was reported in the December issue, was born June 11, 1911 at Newcastle, Staffordshire, England, and was educated in England and Canada. Mr. Minifie entered railway service as a shop laborer for the Canadian Pacific at Cranbrook in August, 1926, transferring to sectionman at Rampart, B. C., April 1, 1927. He was promoted to Class "A" sectionman in August, 1930, and to relieving section foreman in September, 1932. Mr. Minifie was further advanced to section foreman at Shields, B. C., during December, 1937, and to relieving roadmaster on the Kootenay division in September, 1942. In November, 1942, he was promoted to acting roadmaster on the Esquimalt & Nanaimo, a subsidiary of the Canadian Pacific, at Duncan, Vancouver Island.

Andrew B. Baker, whose promotion to supervisor of track on the Grand Rapids division of the Pennsylvania at Grand Rapids, Mich., was reported in the December issue, was born at West Chester, Pa., on August 18, 1916. Mr. Baker was graduated from Lehigh University in 1940 and entered the service of the Pennsylvania as an engineering apprentice at Northumberland, Pa. He was promoted to an assistant in the engineering corps of the Philadelphia division, with headquarters at Harrisburg, Pa., on January 15, 1941, and later to the office of the chief engineer maintenance of way at Philadelphia, Pa. On December 15, 1941, he was promoted to assistant supervisor of track on the New York division at Jamesburg, N. J., and on April 9, 1942, he was transferred to the Pittsburgh division, with headquarters at Derry, Pa.

D. H. Harris, general foreman on the St. Louis division of the Pennsylvania, has been promoted to assistant supervisor of track on the eastern division, succeeding **K. J. Steele,** who has been advanced to supervisor of track on the Panhandle division, with headquarters at Wheeling, W. Va., replacing **L. W. Hogston,** transferred to Terre Haute, Ind., on the St. Louis division. Mr. Hogston replaces **W. R. Garner,** who has been transferred to the Philadelphia division, with headquarters at Harrisburg, Pa., in place of **T. M. Goodfellow,** whose promotion to assistant division engineer on the Philadelphia Terminal division is reported elsewhere in these columns.

Bridge and Building

Carl F. Houser, whose promotion to master carpenter of the Allegheny-Meadville division of the Erie was reported in the November issue, was born at Narrowsburg, N. Y., on February 24, 1906. Mr. Houser entered railway service in March, 1919, as a clerk in the mechanical department of the Erie at Jersey City, N. J., transferring to the maintenance of way department in 1924 as a carpenter on the Terminal division. In 1934 he was promoted to repairman on the Eastern district, and in 1937, was further advanced to assistant master carpenter of the New York division.

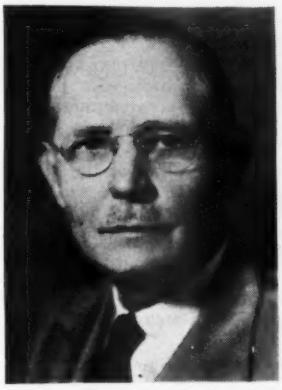
Morris W. Clark, whose promotion to supervisor of building repairs on the Atlantic Coast Line, with headquarters at Savannah, Ga., was reported in the December issue, was born at Savannah on April 5, 1908, and received his higher education at the Citadel, from which he was graduated in 1930 with a degree in civil engineering. In June, 1930, Mr. Clark entered railway service as a chainman with the Atlantic Coast Line at Wilmington, N. C., serving in various capacities until February 1, 1936, when he was advanced to assistant supervisor of building repairs at Rocky Mount, N. C. He served as junior engineer at Wilmington from 1937 to 1938, and as assistant engineer at Savannah from 1938 until January 31, 1939, when he was advanced to office engineer at Savannah.

A. J. Rothwell, whose retirement as bridge and building master of the Regina division of the Canadian National at Regina, Sask., was announced in the December issue, was born near Walkerton, Ont., on November 4, 1877. Mr. Rothwell entered railway service with the Southern Pacific in May, 1904, working on the construction of the Lucin cut-off. He was later employed on bridge construction by the Canadian Pacific and by private contractors during the construction of the Grand Trunk Pacific (now Canadian National). In March, 1915, he entered the service of the Grand Trunk Pacific, becoming bridge and building master at Melville, Sask., in October, 1915. Mr. Rothwell remained in that position with both the Grand Trunk Pacific and its successor, the Canadian National, until July, 1933, when he was transferred to Regina.

Special

John Schofield, dominion construction controller for the Canadian government, has returned to his position as chief architect of the Canadian National, with headquarters at Montreal, Que.

William M. Barr, whose promotion to research and standards consultant of the Union Pacific, with headquarters at Omaha, Nebr., was reported in the December issue, was born at West Union, Ia., on August 26, 1878. Mr. Barr was graduated from the University of Iowa in 1902, later attending Grinnell College and the University of Pennsylvania from the latter of which he received the degree of Doctor of Philosophy in 1908. Mr. Barr first entered railway service in May, 1916, as a consulting chemist for the Union Pacific, later becoming chief chemist and metallurgical engineer, the position he held at the time of his recent promotion.



William M. Barr

Obituary

Charles E. Felton, assistant engineer on the New York Central at New York, died on December 11, 1944.

Henry W. Hayes, who resigned in 1908 as assistant chief engineer of the Boston & Maine to become engineer of grade crossings for the Commonwealth of Massachusetts, died recently at Hollis, N. H.

B. V. Wright, who, in 1918, resigned as chief engineer of the Gulf, Mobile and Northern, now a part of the Gulf, Mobile and Ohio, died recently at Portland, Ore.

W. C. Costigan, who retired on July 31, 1943, as supervisor of track on the Illinois Central, at Carbondale, Ill., died in a sanitarium at Valmora, N. M. Mr. Costigan had been employed by the Illinois Central for more than 40 years as roadmaster and track supervisor at various points.

Herbert Lawrence Ripley, who retired as contract agent of the New York, New Haven & Hartford at New Haven, Conn., in July, 1943, died on December 1 at New York. Mr. Ripley was born at Brewer (Holden), Me., on February 2, 1874, and entered railroad service with the New York, New Haven & Hartford in 1898 as an inspector. After serving in various engineering positions, Mr. Ripley became corporate and valuation engineer in 1920, and was named assistant to the vice-president at Boston, Mass., in 1930. He was appointed contract agent on August 1, 1935.

Alonzo J. Hammond, who resigned in September, 1922, as assistant chief engineer of the Chicago Union Station, died at Washington, D. C., on December 2. Mr. Hammond was born at Thorntown, Ind., on April 23, 1869, and received his higher education at Rose Polytechnic Institute and Massachusetts Institute of Technology. He was employed as an assistant engineer on the Terre Haute and Indianapolis, now part of the Pennsylvania, from 1893 to 1901. For several years he was employed as city engineer by various cities, entering consulting practice in 1910. From 1914 until 1922 he was employed as assistant chief engineer of the Chicago Union Station, which embraced the period of construction of the present union passenger terminal in Chicago. From 1922 until 1927 he was associated with various large contractors, and in the latter year he again entered private consulting practice. Mr. Hammond was a member of the American Railway Engineering Association and president of the American Society of Civil Engineers.

Walter H. Kirkbride, who retired on Jan. 31, 1944, as chief engineer of the Southern Pacific, Pacific lines, with headquarters at San Francisco, Cal., died at Dunsmuir, Cal., on December 20, following a brief illness. Mr. Kirkbride was born at Pueblo, Colo., on January 22, 1874, and graduated in civil engineering from Stanford University in 1895. After serving as a United States deputy mineral surveyor, he entered railway service in 1898 as assistant engineer on location and construction of the Sierra Railway of California. In 1902 he went with the Southern Pacific as an assistant engineer, being advanced to assistant resident engineer in 1906, and to division engineer in 1909. In 1917, Mr. Kirkbride was transferred to the operating department as assistant superintendent of the Sacramento division. A year later, during federal control of the railroads, he was appointed chief engineer of the Southern Pacific, Pacific lines, and in 1920, he was appointed engineer maintenance of way and structures, Pacific lines, holding that position until April, 1932, when he was again promoted to chief engineer. Among the important projects with which he was associated were the new Redding-Delta line around Shasta Dam, the Martinez-Benicia double-track bridge, the longest of its kind west of the Mississippi; the Los Angeles Union Passenger Terminal; the extensive San Jose line change; the San Joaquin Valley line reconstruction and relocation in Soledad Canyon after the 1938 floods; and construction of the 400-ft. span crossing the Colorado River at Yuma, Ariz.

Walter H. Kirkbride

Association News

Wood Preservers' Association

The Executive committee of the association will meet in the Netherlands Plaza hotel, Cincinnati, Ohio, on January 17, to consider routine matters and to set up plans for the annual meeting of the association, tentatively scheduled some time in May.

Bridge and Building Association

The Executive committee of the association met in Chicago on December 11, when, following the disposal of routine business, it gave primary consideration to the selection of the personnel of committees to compile reports for presentation at the next Annual Meeting of the association. Tentatively, the dates for this meeting were set as October 16, 17 and 18, Chicago.

Roadmasters' Association

Upon the call of President E. L. Banion, the Executive committee of the association met in Chicago on December 16. Following the disposal of routine matters, it gave its attention to the selection of the personnel of the six technical committees that will conduct studies and make reports at the next Annual Meeting of the association, which has been scheduled tentatively, at the Hotel Stevens, Chicago, on September 18, 19 and 20.

Metropolitan Maintenance of Way Club

The Metropolitan Maintenance of Way Club will hold a dinner meeting in the Governor room of the Hotel Governor Clinton, New York City, on February 8. At the December 7 luncheon meeting of the club, 90 members and guests were present to hear Col. A. L. Bartlett, engineer maintenance of way, New York, New Haven & Hartford, present an address on "The New Era." Col. Bartlett discussed the problems that will face railway maintenance forces after the war and predicted a large increase in the use of work equipment. He also suggested that the railways avoid the purchase of second-hand equipment that will be offered for sale by government agencies and contractors, and confine their purchases to new equipment designed specifically for railway needs.

Maintenance of Way Club of Chicago

With an attendance of 133 members and guests, the December meeting of the Club was held on Monday evening, December 18, in the Ambassador Room of Huyler's Restaurant, Chicago. The feature of the meeting was an address by Charles Layng, western editor of the Railway Age, on Axis Transportation in Europe and Asia. Basing his remarks upon widespread travel in foreign countries, his experience as consultant to the United States Army on transportation facilities in Axis and Axis-dominated countries, and upon close observation of current war strategy, Mr. Layng spoke at some length concerning standards of track construction in France, Italy, Germany, Japan and China; told of the plans of the Allied air forces for disrupting rail communication lines and centers in the war zones; described the technique of aerial bombing of tracks, bridges and locomotives; and ended with a plea that railway men on the home front do a job comparable to the outstanding job being done by railway men on the war front.

The next meeting of the Club will be held on January 22, at the usual place, and will be addressed by A. A. Miller, chief engineer maintenance of way and structures, Missouri Pacific, and G. M. Magee, research engineer, Association of American Railroads, both of whom will discuss Rail Damage.

American Railway Engineering Association

With the work of the standing committees of the association for the year drawing to a close, only one committee held a meeting in December and only one has scheduled a meeting in January. The Committee on Rail met in Chicago on December 7, and the Committee on Economics of Railway Location and Operation will meet in Louisville, Ky., on January 24.

The Board of Direction and the Nominating committee met in Chicago on December 6 to plan the affairs of the association and to prepare a slate of nominations for officers for the coming year, it having been decided by the Board to hold an annual election whether or not an annual meeting is held in March. No action was taken concerning the March meeting, although it is expected that a definite decision in this regard will be arrived at some time during January.

At the Board meeting, three standing committees of the association—Signals and Interlocking, Electricity and Standardization—were eliminated and a more simple procedure adopted to keep the association informed on the matters formerly handled by these committees. Furthermore, the association's special committee on research administration, of which C. E. Smith, vice-president, New York, New Haven & Hartford, was chairman, was also eliminated, this committee having been set up a few years ago as an interim committee on research upon the dropping of the association's earlier committee on Stresses in Railroad Track.

During the last month, Bulletin No. 449 was mailed to members, and during January they will receive Bulletin No. 450, which will include reports of the committees on Impact, Masonry, Records and Accounts, Co-Operative Relations With Universities, and Wood, Bridges and Trestles.

As a result of the action of the Nominating committee, the following names will appear on the ballot for officers to be mailed shortly to members; President, A. A. Miller, chief engineer maintenance of way and structures, Missouri Pacific, St. Louis, Mo.; Vice-President, C. J. Geyer, general manager, Chesapeake & Ohio, Richmond, Va.; directors (three to be elected), F. E. Bates, chief engineer, Missouri Pacific, St. Louis, Mo.; G. A. Haggander, assistant chief engineer, Burlington Lines, Chicago; W. M. Wilson, research professor of structural engineering, University of Illinois, Urbana, Ill.; H. Austill, chief engineer, Terminal Railroad Association of St. Louis, St. Louis, Mo.; L. P. Kimball, engineer of buildings, Baltimore & Ohio, Baltimore, Md.; L. L. Adams, assistant chief engineer, Louisville & Nashville, Louisville, Ky.; R. E. Dougherty, vice-president, New York Central System, New York; R. L. Schmid, chief engineer, Nashville, Chattanooga & St. Louis, Nashville, Tenn.; and E. E. Oviatt, chief engineer, New York, New Haven & Hartford, New Haven, Conn.

For members of the Nominating committee (five to be elected); Edward Wise, Jr., engineer maintenance of way, Louisville & Nashville, Louisville, Ky.; J. S. McBride, chief engineer, Chicago & Eastern Illinois, Chicago; F. J. Bishop, engineer maintenance of way, Toledo Terminal Railroad, Toledo, Ohio; W. G. Nusz, office engineer, Illinois Central, Chicago; H. L. Restall, valuation engineer, Boston & Maine, Boston, Mass.; R. J. Gammie, chief engineer, Texas & Pacific, Dallas, Tex.; F. S. Hewes, office engineer, Atchison, Topeka & Santa Fe, Chicago; H. F. Burch, assistant general manager, Delaware & Hudson, Albany, N.Y.; H. F. King, special engineer, Erie, Cleveland, Ohio; and A. B. Stone, assistant chief engineer, Norfolk & Western, Roanoke, Va.

In addition to the above names to be balloted upon, J. B. Akers, assistant chief engineer, Southern, Washington, D.C., will be advanced automatically to the position of senior vice-president.

Supply Trade News

General

The **Alloys Development Company** has announced the licensing of the **Carnegie-Illinois Steel Corporation** and other subsidiaries of the United States Steel Corporation, the **Republic Steel Corporation,** and the **Lukens Steel Company,** for the manufacture of "Aldecor," a steel of the "Cor-Ten" type, which resulted from the research of the Alloys Company and was developed by Republic during the last three years. With the recent announcement by Carnegie-Illinois that both Republic and Lukens have taken licenses for the manufacture of "Cor-Ten," the acceptance of licenses for the production of "Aldecor" makes both materials available from several large producers.

Personal

W. H. Brewer, general manager of the Aurora, Ill., factory of the Independent Pneumatic Tool Company, has retired.

Fred T. Kennedy has been appointed general manager of the **Blackmer Pump**

(Continued on page 80)

SCHRAMM'S Crawler-Compressor

Goes anywhere air power is needed

Consider the Schramm crawler's advantages as an off-track compressor. It climbs anywhere—up steep embankments or across ditches. Narrow, it fits between rails or on the shoulder. This means you get your power up close to where you use it; long lengths of hose are *out*.

The crawler is just one of the several Schramm maintenance of way compressors. There are other off-track mountings, both crawler and wheeled types including a handy little hand-pusher. And rail car mountings too, of course, both towed and self-propelled. All have dependable water cooling for efficient operation at all temperatures; all have the positive cam-operated Schramm intake valve for more air on less fuel. Send for the maintenance of way circular, MW44.

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WEST CHESTER, PENNSYLVANIA

Company, with headquarters at Grand Rapids, Mich. Mr. Kennedy has, until recently, been on the staff of the War Production Board at Washington, Dc C.

Paul J. Wolfert, assistant to the manager of construction equipment of the **Blaw-Knox Company,** has been promoted to export department engineer, with headquarters in New York.

N. Spencer Robertson, president of the **Permutit Company** of New York has been elected chairman of the board and **Henry W. Foulds,** executive vice-president, has been elected president.

John B. Tinnon, vice-president in charge of sales of the **Metal and Thermit Corporation,** New York, and **Walton S. Smith,** vice-president in charge of production, have been elected to the board of directors of the corporation.

J. M. Driscoll, manager of the Cleveland, Ohio, industrial sales office of the Air Reduction Sales Company, has been appointed manager of railroad sales, northern division, with offices in Cleveland. **S. H. Newburn** has been appointed acting manager of the Cleveland industrial sales office.

Harold F. Allen, whose promotion to chief engineer of the Link-Belt Speeder Corporation, with headquarters at Chicago, Ill., and Cedar Rapids, Iowa, was reported in the December issue, is a graduate of Columbia University, and in 1916 he went with the Link-Belt Company (now the

Harold F. Allen

Link-Belt Speeder Corporation), with which he subsequently served in several important capacities. In 1938 he was promoted to service manager, with headquarters at Chicago, and in 1943 he was advanced to the position he held at the time of his new appointment.

The Warren Tool Corporation has moved its general sales office from Warren, Ohio, to 2119 Bankers Building, 105 West Adams Street, Chicago 3, Ill., which will be the new headquarters of Howard Mull, general sales manager. At the same time it announced the appointment of **Karl F. Baumann** as assistant sales manager, with headquarters at Chicago.

Lyle E. Hill, priorities supervisor and special traveling representative of the purchasing department of the **Caterpillar Tractor Company,** Peoria, Ill., has been promoted to head of the company's Railroad Power division, with headquarters as before at Peoria. Mr. Hill joined the Caterpillar organization in 1941 after

Lyle E. Hill

serving for more than 19 years with the mechanical department of the Chicago & North Western. He was assigned to the company's Engine Sales department and some time later he was advanced to the position he held at the time of his new appointment.

Merwin T. Farley has been appointed supervisor of the Parts depots of the **Caterpillar Tractor Company,** Peoria, Ill. He formerly assisted the company's purchasing department in military procurement and, last year, developed the company's military parts processing program. Mr. Farley's responsibilities for parts processing have been assigned to **D. M. Gilbert,** general superintendent of parts, and **Harold H. Bosecker** has been promoted to superintendent of parts processing.

W. Conroy Wilson has been appointed sales and service engineer for **Ralph W. Payne,** railway appliances and equipment, Washington, D. C. Mr. Wilson attended William and Mary College. He joined the Virginian in 1938, serving successively as transportation inspector of the Norfolk division, assistant trainmaster of the New River division, and trainmaster of the Norfolk division, which latter position he held at the time of his new appointment.

George E. Horney has been appointed assistant to the president and has been elected a director of the **Pittsburgh Screw & Bolt Corp.,** with headquarters at Pittsburgh, Pa. Mr. Horney formerly was resident vice-president of the company's Gary Screw and Bolt division. **Gerald J. Garvey,** a member of the sales department of the Gary Screw and Bolt division, has been appointed general manager of that division, with headquarters in Chicago.

R. M. Hamilton, vice-president of the T. J. Moss Tie Company, St. Louis, Mo., has resigned to become executive vice-president of **D. B. Frampton & Co.,** Pittsburgh, Pa., and the **Baker Wood Preserving Company,** Marion, Ohio, with general supervision over sales and operations.

George M. Cooper, southwestern representative of the Southern Wheel and Brake Shoe & Castings divisions of the American Brake Shoe Company, with headquarters at Houston, Tex., has been appointed sales manager of **Eastern Railway Supplies, Inc.,** New York, to succeed **W. E. Bugbee,** who has resigned to become a manufacturers' representative for railway equipment and supplies in the Southwest, with headquarters at San Antonio, Tex. **James F. Hartley,** formerly in charge of the Cleveland, Ohio, territory for the Buda Company, has been appointed sales and service engineer of Eastern Railway Supplies, with headquarters at New York.

Obituary

George S. Whyte, founder and chairman of the board of the Macwhyte Company died of a heart attack at his home in Kenosha, Wis., on December 15.

Frank B. Archibald, vice-president of the National Lock Washer Company, at Newark, N.J., died at a hospital in New Rochelle, N.Y., on December 19.

Frank W. Capp, structural engineer for the Portland Cement Association, at Chicago, died at his office on December 22. Mr. Capp was born on June 6, 1887, at St. John, N.B., and received his higher education at the University of Missouri. He was employed as a draftsman with the American Bridge Company at Toledo, Ohio, during 1909 and 1910, resigning to become an instructor in civil engineering at the University of Missouri. In 1912 he entered railway service with the Kansas City Terminal, and in 1913 went with the bridge department of the Great

Frank W. Capp

Northern as a designer. Mr. Capp joined the staff of Adolf W. Meyer, consulting hydraulic engineer, in 1920, as an assistant engineer, remaining in that position until 1924, when he became an assistant engineer on the Illinois Central on its Chicago terminal improvements. In 1927 he was appointed structural engineer of the Portland Cement Association at Chicago. In his latter employment, Mr. Capp had a large part in the development of the process of track stabilization by pressure injection of chement grout into the subgrade, having supervised the first such installation made in 1936.

Anticipate the challenge of post-war competition; redesign your equipment now and use more Timken Bearings.

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All need their smoothness of operation; radial, thrust and combined load capacity; endurance; simplicity of lubrication; prevention of hot axles with attendant delays; and radical reduction of time out for maintenance.

No matter how well a section car may be designed and built in other respects, it still is dependent upon its bearings to a very great extent for efficient, dependable performance. Specify Timken Bearings when buying new section cars of any kind. The Timken Roller Bearing Company, Canton, Ohio.

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5 H. P. MALL gasoline engine chain saw—36" capacity.
Also available in 24" and 48" sizes.

A 15-Hour Job for 2 Carpenters with a Cross Cut Saw

Unskilled laborers can now cut and top piles, square heavy timbers to size and fell trees with MALL Chain Saws after a few minutes instruction—at a surprisingly low cost. The 2-cycle design gasoline engine starts easily . . . has stall-proof clutch and handle throttle, and uses little fuel. The 360 degree index permits sawing at any angle. Safety guard assures full protection. Pneumatic models also available. Electric sharpeners are available for sharpening chains.

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Available in **24", 36" and 48" Cutting Capacities**
Particularly adaptable to cutting piling under water.

ELECTRIC Mall Saw

2 powerful models with 8½" and 4½" blades, 2¾" and 4½" cutting capacities for cross cutting, ripping and beveling rough and dressed lumber; also cutting non-ferrous metal, cutting and scoring concrete, tile and stone with an abrasive wheel.

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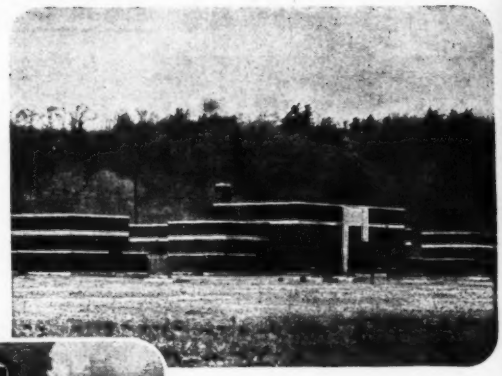

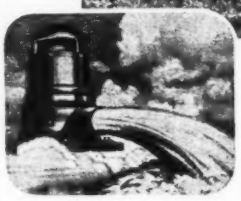

For Schenectady

45,000,000 Gallons Daily From 9 Layne Units

Late in 1942, Schenectady faced a serious water crisis. New war industries and increased population demanded more and more water. The old system was over-burdened. Reserve was diminishing a million gallons daily.

Layne was given a contract that covered wells, pumps, electrical equipment and other essential apparatus. Layne New York Company put full crews on the job and in record time completed two wells in time to prevent a crisis. Seven other wells and pumps were soon ready and in service, giving Schenectady 45,000,000 gallons of fine water daily—and at a saving of $10,000 a year on operating cost.

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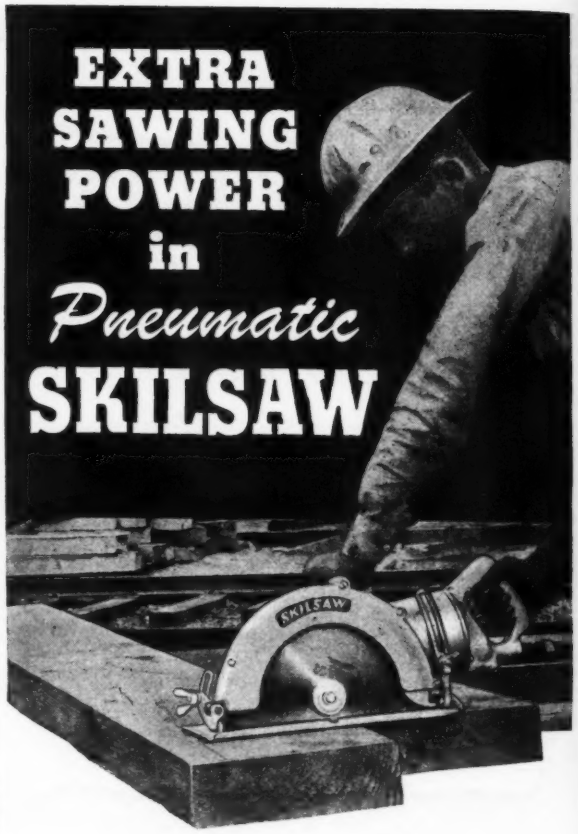

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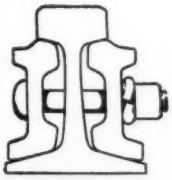

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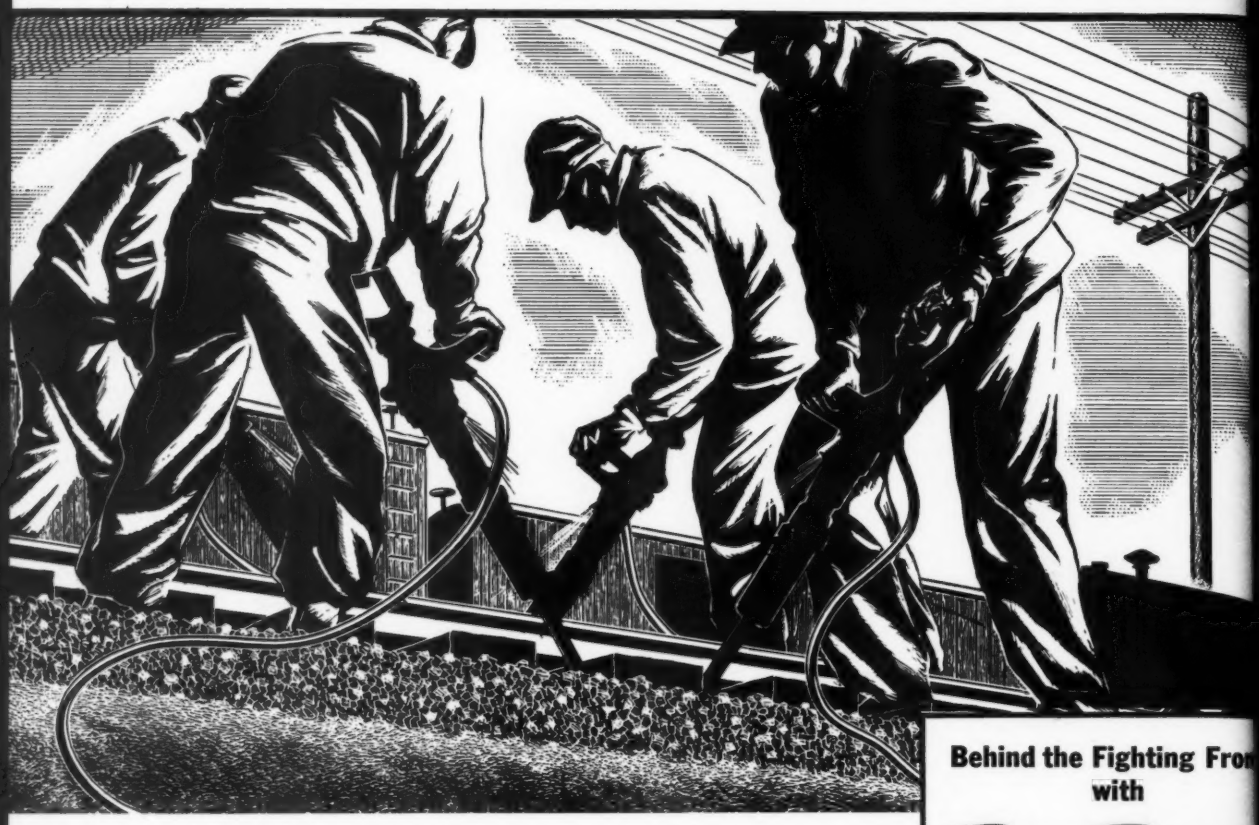

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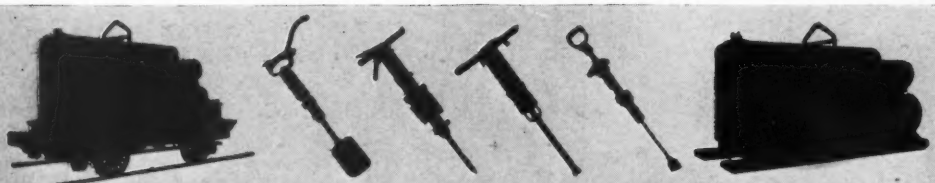

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